CA2 ON EV.506 R54A c.2

APPENDIX SUPPLEMENT

OPERATIONAL VARIABLES AND LIMITATIONS OF DIRECT FILTRATION

1975

RESEARCH REPORT NO. W54





The Honourable William G. Newman, Minister

Everett Biggs, Deputy Minister Copyright Provisions and Restrictions on Copying:

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CAR ON EV.506 R54A C.2

APPENDIX SUPPLEMENT

OPERATIONAL VARIABLES AND LIMITATIONS

OF

DIRECT FILTRATION

by

W. R. Hutchison

Water Technology Section Pollution Control Branch

Research Report No. W54

January 1975

Ministry of the Environment 135 St. Clair Ave. W., Toronto, Ont.

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High Raw Water Turbidity

Oct.	13,	1972	Sarnia
Oct.	16,	1972	Sarnia
Jan.	28,	1974	Sarnia
July	4.	1973	Sarnia

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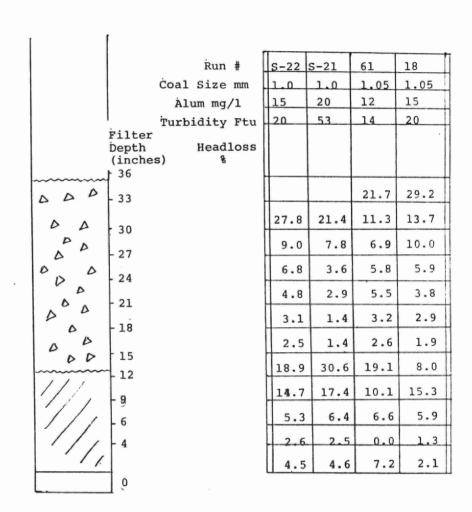
APPENDIX 1

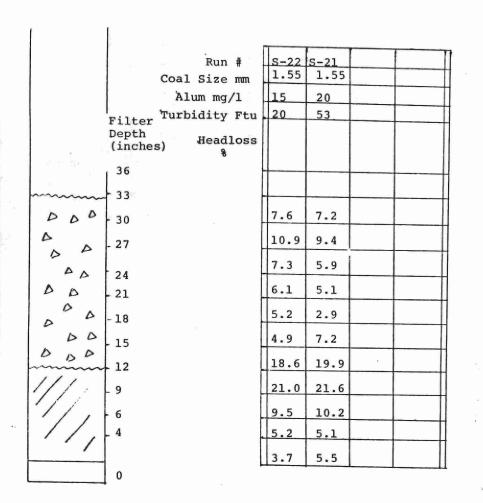
Omano							APPENDIX I									DIREC.	LEILIRATIC	11N	
Date	Run #	Temp o _F	F		r Medi Coal		Filtration Rate		icals	Turk		Floce	ulation	Head Ft		Run Length	Total Filtered	Head Lo	
					Depth	Eff	IGPM/ft ²	ppm	ppm	FTU	FTU	G Sec	Time min.	Final	Break Through	Hours	Imp. Gal/ft ²	Coal %	Sand %
Oct 16	S-22	54	12	0.45	20	0.9	4	15	0	20*	0.18	20	14.5	6	6	11.5	2,750	74	26
			13	0.45	21	1.0	4	15	. 0	20	0.18	20	14.5	4.5	4.5	11.5	2,750	54	46
-			12	0.45	20	1.55	4	15	0	20	0.20	20	14.5	3	3	7.2	1,750	42	58
Oct 13	s-21	54	12	0.45	20	0.9	4	20	0	53*		20	14.5	3.5	3.5	2.3	550	71	29
		3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	13	0.45	21	1.0	4	20	0	53	-	20	14.5	3	3	2	500	39	61
			12	0.45	20	1.55	4	20	0	53	-	20	14.5	2.5	2.5	1.5	350	38	62
Jan 28	61	33	13	0.45	22	0.9	4	12	0	14**	0.23	20	14.5	5.8	5.8	15.0	3,600	71	29
			13	0.45	22	1.05	4	12	0	14	0.20	20	14.5	4.3	4.3	13.5	3,250	57	43
			13	0.45	22	1.55	4	12	0	14	0.23	20	14.5	4.3	4.3	11.8	2,850	54	46
July 4	18	53	13	0.45	22	0.9	4	15	0	20**	0.14	20	14.5	7.5	7.5	9.5	2,300	87	13
			13	0.45	22	1.05	4	15	0	20	0.20	20	14.5	4.0	4.0	8.5	2,050	67	33
2			13	0.45	22	1.55	4	15	0	20	0.20	20	14.5	2.5	2.5	4.5	1,100	54	46
MOE 08	-114 6-2	74				and the state of t				*		al Tur!	oidity ided to	raw wat	er				-2-
11	14	1	i	1 11	1	1	1 11	1	. 1	e l	1		,		7.6	, ,			

Appendix 1
HEADLOSS DISTRIBUTION RESULTS

S-22 S-21 Run # 0.9 0.9 Coal Size mm 20 Alum mg/l 15 20 Turbidity Ftu Filter Depth (inches) Headloss 36 33 30 51.0 54.7 27 8.3 10.0 24 3.9 6.5 21 2.4 5.9 18 1.6 0.7 15 3.2 1.6 12 13.8 12.6 6.3 4.9 2.4 2.3 3.3 4.6

Appendix 1





1		
Run #	61 18	
Ćoal Size mm	0.9 0.9	
Alum mg/l	12 15	
Turbidity Ftu	14 20	
Filter Depth Headloss (inches) %		
D D -33	25.7 53.6	
A A A 30	16.2 16.5	
A A -27	12.1 7.5	
A A 24	8.8 4.5	
D D D 21	3.5 3.0	
	4.4 1.1	
D D D 0 -15	0.6 0.4	
12	7.5 5.9	
1/1/ 9	10.1 3.1	
- 6	3.7 2.3	
4	2.7 0.7	
0	4.7 1.4	

Appendix 1

HEADLOSS DISTRIBUTION RESULTS

ı		•			
		Run #	61	18	
		Coal Size mm	1.55	1.55	
		Alum mg/l	12	15	
		Turbidity Ftu	14	20	
1		Filter			
		Depth (inches) Headloss			
1		36	H		
	AAA	- 33	9.8	14.2	
	ΔΔ	-30	10.1	11.9	
	0 0	- 27	6.7	7.2	
	DD	-24	4.5	5.0	
	DDD	- 21	5.6	4.7	
	D D	-18	5.9	4.7	
,	0 0	-15	11.0	6.5	
		-12	15.6	15.9	
	///	- 9	14.9	13.7	
	///	- 6	7.3	7.2	
	1/,	- 4	3.3	2.9	
			5.3	6.1	
		0			

High Raw Water Turbidity

July	12,	1973	Sarnia
		1973	Sarnia
July	11,	1973	Sarnia
July	18,	1973	Sarnia

APPENDIX 2

Data			11			1	1	i		1									
Date Ru		Temp o _F	l		r Medi		Filtration Rate		icals		oidity	Floce	culation	Head Ft		Run Length	Total Filtered	Head Lo	
		F	San		Coal		IGPM/ft ²	Ppm	Poly	Raw FTU	Eff. FTU		Time	Final	Break			Coal	Sand
			in.	mm	1	1 1		Pp	PP···	*	1	G Sec-1	1		Through	Hours	Imp. Gal/ft ²	96	8
uly	22	66	13	0.45	22	0.9	4	12	0	40	0.35	20	18	2.6	2.6	5	1,200	74	26
			13	0.45	22	1.05	4	12	0	40	0.35	20	18	2.3	2.3	6	1,450	56	44
	•	5	13	0.45	22	1.55	4	12	0	40	1.5	20	18	1.8	1.8	3	700	33	67
10 uly	20	57	13	0.45	22	0.9	4	17	0	40	0.25	20	18	5.8	5.8	9.5	2,300	85	15
		-	13	0.45	22	1.05	4	17	0	40	0.25	20	18	3.7	3.7	7.5	1,800	63	37
			13	0.45	22	1.55	4	17	0	40	0.25	20	18	2.8	2.8	5.5	1,300	52	48
	=	ă	2																
uly ¹¹	21	63	13	0.45	22	0.9	4	28	0	40	0.18	20	18	1.8	1.8	2.5	600	74	36
	e l		13	0.45	22	1.05	4	28	0	40	0.20	20	18	2.0	2.0	2.8	650	51	49
			13	0.45	22	1.55	4	28	0	40	0.18	20	18	1.8	1.8	2.5	600	34	66
-																			
uly 18	25	65	13	0.45	22	0.9	4	20	0	80+	0.25	20	18	2.5	2.5	4.5	1,100	81	19
			13	0.45	22	1.05	4	20	0	80+	0.25	20	18	2.0	2.0	3.3	800	62	38
			13	0.45	22	1.55	4	20	0	80+	0.25	20	18	1.8	1.8	2.8	650	36	64
										*	Turbi	dity a	dded to	aw wate	r				-7
MOE 08-1	 14 6-7	74																	'

Appendix 2

Run # 20 21 25 Coal Size mm 0.9 0.9 0.9 0.9 Alum mg/l 17 28 20 Turbidity Ftu 40 40 40 **80+** Filter Depth Headloss (inches) 20.2 36.8 34.8 32.1 33 25.1 20.9 19.8 27.3 12.2 10.5 7.2 12.6 27 7.6 6.6 6.2 4.7 24 3.5 3.6 2.1 2.7 21 4.0 2.6 2.6 2.0 -18 1.1 2.1 1.0 15 12 5.6 1.6 4.7 6.7 9.6 7.6 10.3 8.0 5.1 3.9 4.1 3.3 2.5 0.6 3.5 2.4 4.1 0.0

Appendix 2 HEADLOSS DISTRIBUTION RESULTS

.				>		
		Run #	22_	20	21	25
	Coal	Size mm	1.05	1.05	1.05	1.05
	'A.	lum mg/l	12	17	28	20
!		lity Ftu	40	40	40	80+
Г	'ilter epth (inches)	Headloss		ÿ		
~~~~	36	8	H			
A A	- 33		20.9	29.1	9.4	13.1
0.5	- 30		15.2	14.2	23.0	22.1
	- 27		8.4	7.5	8.6	11.1
	- 24		4.1	4.6	4.3	7.1
.> .>	- 21		3.5	3.2	2.9	0.0
5 5	- 18		2.1	2.4	2.9	-
2.7	- 15		1.3	1.6	_	5.1
			19.5	13.1	12.2	3.1
11.	12		15.3	12.2	19.4	23.1
	- 9 - 6		5.5	5.9	8.7	8.1
1//	4		2.1	2.7	3.6	1.1
			2.1	3.5	5.0	6.1

Appendix 2

1							
		Run	#	22	20	21	25
	Ò	oal Size	mm	1.55	1.55	1.55	1.55
1		Alum mg/	/1	12	17	28	20
	Filter T	urbidity	Ftu	40	40	40	80+
	Depth (inches)	Head?	loss				
	<del>-</del> 36	(e)	1	<del> </del>			
DDA	- 33			9.0	15.5	8.0	12.4
A A	- 30			7.2	11.5	9.6	11.3
D DD	- 27			5.9	8.5	6.4	7.3
Δ	24			4.2	6.0	3.8	5.2
AA	-21		[	3.6	4.5	1.9	0.0
Δ Δ	18			3.0	5.5	3.8	-
A A	-15			9.5	5.5	5.2	8.2
0 0	- 12		[	27.6	17.0	26.9	22.7
1///	- 9	(*		13.8	11.5	16.6	15.4
1///	-6			7.8	7.5	8.9	11.3
1//,	- 4			3.6	3.5	3.2	0.0
- /				4.8	3.5	5.7	6.2
	0		100				

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High Raw Water Turbidity

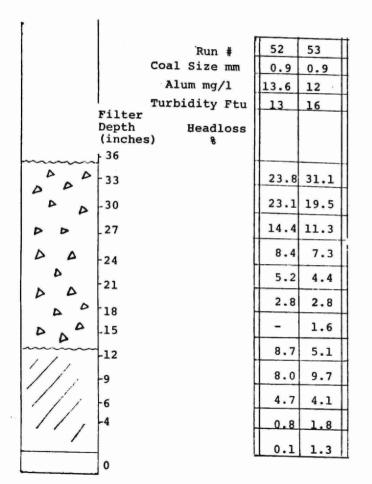
Oct. 25, 1973 Sarnia Oct. 29, 1973 Sarnia

7

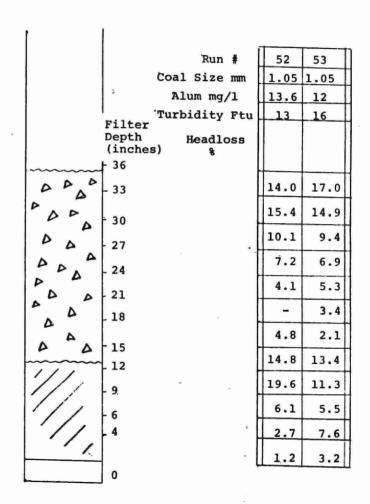
APPENDIX 3

Ontario							APPENDIX 3							<u> </u>		DIREC	r FILTRATIC	)N	
Date	Run #	Temp O _F			r Medi		Filtration Rate			L		Floc	culation	Head Ft		Run Length	Total Filtered	Head Lo	
		F	11	Eff.		Eff	IGPM/ft ²		Poly	Raw	FTU	G _1	Time		Break Through		Town	Coal	Sand %
			in.	mm	in.	mm				*		G Sec-1	min.				041/11		
Oct 25	52	56	13	0.45	22	0.9	4	13.6	0	13	0.14	20	14.5	8	-	15.4	3,700	77	23
			13	0.45	22	1.05	4	13.6	0	13	0.14	20	14.5	7	7	16.0	3,850	56	44
			13	0.45	22	1.55	4	13.6	0	13	0.14	20	14.5	7	7	13.5	3,250	51	49
																140-1 0 1			
)ct 29	53	55	13	0.45	22	0.9	4	12	0	16	0.14	20	14.5	8	-	16.0	3,850	78	22
			13	0.45	22	1.05	4	12	0	16	0.15	20	14.5	6	6	14.5	3,500	59	41
			13	0.45	22	1.55	4	12	0	16	0.13	20	14.5	6	6	13.5	3,250	49	51
		=																	
														×					
	5																	W	
																(G =			
							-	And Andrews											
																- The state of the			
										*	Turbi	dity a	dded to	aw wate	er.				
MOE 08-1		4																	
MOE QO-						1			ł	l i	1	1	1	1	11	11	11		

Appendix 3
HEADLOSS DISTRIBUTION RESULTS



Appendix 3



· ·	1		
		-	
	Run #	52	53
	Coal Size mm	1.55	1.55
	Alum mg/l	13.6	12
\$ 100 mg	Turbidity Ftu	13	16
* ;	Filter Depth (inches) Headloss		
	± 36 °		
AA	_ 33	12.2	7.1
DDD	- 30	14.4	11.2
DD	-27	7.7	8.8
DAD	- 24	5.5	6.8
DA	- 21	5.0	7.8
ΔΔ	-18	6.5	7.0
Δ Δ Δ Δ	-15	14.4	8.5
	-12	18.0	11.8
1///	- 9	8.1	16.3
1//,	- 6	2.7	7.3
11/1	- 4	3.3	4.1
///		2.2	3.3
	0		

113-

High Raw Water Turbidity
Filtration Rate 6 Igpm/sq ft

Oct. 18, 1972 Oct. 17, 1972 Oct. 12, 1972

APPENDIX

Ontario ,	<u> </u>					APPENDIX 4					DIRECT P				I FILITATION				
Date	Run #	Temp O _F	<u> </u>		r Medi		Filtration Rate		,			Floca	culation	Head Ft		Run Length	Total Filtered	Head Lo	
		F	San		Coal			Alum	Poly	Raw				Final	Break			Coal	Sand
			Depth	Eff.		1	IGPM/ft ²	ppm	ppm	FTU		_	Time		Through	Hours	Imp. Gal/ft	8	1
			in.	mm	in.	mm				*		G Sec-1	min.				Gal/It	75	8
Oct 18	S-26	48	12	0.45	20	0.9	6	15	0	7	0.18	20	8	8	-	8.7	3,100	78	22
			13	0.45	21	1.0	6	15	0	7	0.18	20	8	8	-	10.0	3,600	54	46
			12	0.45	20	1.55	6	15	0	7	0.18	20	8	8	-	9.5	3,400	33	67
		5								ll .									
Oct 17	s-25	54	12	0.45	20	0.9	6	15	0	18	0.19	20	18	4.2	4.2	4.5	1,600	69	31
			13	0.45	21	1.0	6	15	0	18	0.19	20	18	3.6	3.6	4.2	1,500	51	49
	-	-	12	0.45	20	1.55	6	15	0	18	0.23	20	18	2.5	2.5	2.8	1,000	40	60
														-					
Oct 17	S-24	54	12	0.45	20	0.9	6	15	0	19	0.20	20	14.5	5.6	5.6	5.8	2,100	77	23
			13	0.45	21	1.0	6	15	0	19	0.21	20	14.5	4	4	5.2	1,850	55	45
			12	0.45	20	1.55	6	15	0	19	0.25	20	14.5	3	3	3.6	1,300	33	67
		-															·		
Oct 12	S-20	54	12	0.45	20	0.9	6	20	0	45	0.30	20	14.5	3.5	3.5	2.5	900	76	24
			13	0.45	21	1.0	6	20	0	45	0.30	20	14.5	3	3	2.5	900	52	48
			12	0.45	20	1.55	6	20	0	45	0.30	20	14.5	2.8	2.8	2.0	700	37	63
	~ .									*	Natura	1							-15-
MOE 08 -	114 6-7	.																	1
MOL VO		•		li	i	1	! !!		1	1 1	,	1 1					9.75		

Appendix 4

Appendix 4

1	
Run #	S-26 S-25 S-24 S-20
Coal Size mm	0.9 0.9 0.9 0.9
Alum mg/l	15 15 15 20
Turbidity Ftu	7 18 19 45
Depth (inches) Headloss	
-33	
D D - 30	
Δ A -27	57.0 50.5 57.1 61.8
D -24	11.8 8.0 11.2 7.3
D D 21	5.0 4.9 5.4 3.8
D D -18	3.2 4.0 2.7 2.2
15	1.5 1.3 1.1 1.4
12	3.7 5.2 3.4 4.1
1//// 9	15.3 13.2 11.7 6.5
1/// 6	2.3 5.2 4.3 7.8
1///4	0.2 3.1 1.1 2.7
0	0.0 4.6 2.0 2.4

F	tun #	S-26	S-25	S-24	S-20
Coal Si	ze mm	1.0	1.0	1.0	1.0
Alum	mg/1	15	15	15	20
Turbidi	ty Ftu	7	18	19	45
Filter Depth He (inches)	adloss				
36					
D D 33		ļ			
A A A 30		29.0	27.1	27.4	32.0
D D 27		10.0	9.9	12.5	8.8
D D -24	•	6.1	5.6	6.6	4.6
A - 21		4.1	3.6	4.3	4.2
A -		2.6	2.4	2.3	1.6
A - 15		1.9	2.8	2.3	1.3
12		24.7	18.4	18.5	19.0
1/// 9		15.7	19.9	18.5	17.8
///6		4.1	5.2	3.9	4.9
1// 4		1.2	2.8	1.9	2.9
///	(9)	0.6	2.3	1.8	2.9
0			•		

Appendix 4

w.					
					· · ·
	Run #	S-26	S-25	S-24	S-20
	Coal Size mm	1.55	1.55	1.55	1.55
İ	Alum mg/l	15	15	15	20
	Turbidity Ftu	7	18	19	45
	Depth (inches) Headloss				
	36	<del> </del>			
~~~~	- 33				
DDDD	- 30	7.2	7.1	7.8	9.6
000	_ 27	8.8	12.3	8.1	10.5
000	24	6.7	8.4	7.2	6.5
0 0	-21	5.7	5.9	4.9	6.2
A A	- 18	5.0	6.5	5.2	4.3
0 0 0	- 15	7.2	5.2	6.5	7.1
000	-12	23.8	14.3	25.2	5.2
////	· 9	22.9	18.8	17.7	32.2
1//	- 6	6.7	10.4	8.2	7.8
1///	. 4	2.7	5.9	4.9	5.3
		3.3	5.2	4.3	5.3

High Raw Water Turbidity Polymer as a Filter Aid

> July 17, 1973 July 23, 1973 Aug. 9, 1973

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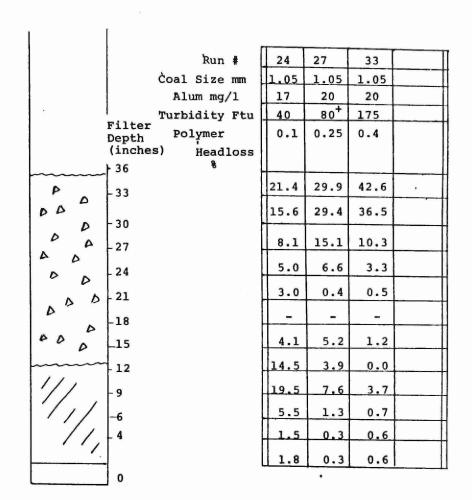
APPENDIX 5

Date	Run #	Temp O _F	F		r Medi Coal	a .	Filtration Rate	-	icals	Turl	idity Eff.	Floce	culation	Head Ft	11 111 110 110	Run Length	Total Filtered	Head Lo	
					Depth	Eff	IGPM/ft ²	ppm	ppm *	FTU	FTU	G Sec ⁻¹	Time	Final	Break Through	Hours	Imp. Gal/ft ²	Coal	Sand %
July 17	24	65	13	0.45	22	0.9	4	17	0.1	40	0.17	20	18	8	_	13.0	3,100	77	29
			13	0.45	22	1.05	4	17	0.1	40	0.18	20	18	6.5	6.5	12.0	2,900	57	43
	•		13	0.45	22	1.55	4	17	0.6	40	0.25	20	18	8	-	9.2	2,200	92	8
23																			
July	27	68	13	0.45	22	0.9	4	20	0.20	80+	0.20	20	18	8	-	11	2,650	95	5
		,	13	0.45	22	1.05	4	20	0.25	80+	0.25	20	18	8	-	11	2,650	77	23
			13	0.45	22	1.55	4	20	0.45	80+	0.25	20	18	8	-	9	2,150	95	5
Aug 9	33	65	13	0.45	22	0.9	4	20	0.4	175	0.28	20	18	8	-	7.5	1,800	97	3
			13	0.45	22	1.05	4	20	0.4	175	0.35	20	18	8	-	9.8	2,350	94	6
			13	0.45	22	1.55	4	20	0.4	175	0.31	20	18	8	-	12.5	3,000	71	29
												•							
											r .								
										* *	Separ Turbi	an NPi dity a	10 ided to	aw wate	r				-19-
MOE 08-	114 6-7	4 :									des missions							1	

Appendix 5
HEADLOSS DISTRIBUTION RESULTS

Appendix 5
HEADLOSS DISTRIBUTION RESULTS

ĺ	1				
	Řun #	24	27	33	
	Coal Size mm	0.9	0.9	0.9	
	Alum mg/l	17	20	20	
	Turbidity Ftu	40	80+	175	
	Filter Polymer	0.1	0.2	0.4	
	(inches) Headloss			,	
D P	33	34.2	36.6	53.5	
A A A	30	21.7	37.8	38.5	
DDD	- 27	10.5	13.6	4.2	
DOD	- 24	5.5	4.9	0.4	
D	-21	3.1	2.5	0.1	
0 0	18	2.2	0.0	0.3	
12 0	-15	-	-	-	
mm	. 12	9.3	0.9	1.6	
1//	- 9	10.0	1.9	0.0	
//,	6	2.3	0.9	1.0	
//	4	0.7	0.1	0.0	
		0.5	0.8	0.4	
in the second	0				



Appendix 5
HEADLOSS DISTRIBUTION RESULTS

1					
	Run #	24	27	- 33	
*	Coal Size mm	1.55	1.55	1.55	*
	Alum	17	20	20	
	Filter Turbidity Ftu	40	80+	175	
	Depth Polymer (inches)	0.6	0.45	0.4	
	→ 36 Headloss				
ADA	- 33	39.5	44.3	21.0	
00	_30	31.0	36.0	25.7	
D A	- 27	13.1	10.7	13.5	
D D	24	6.0	3.4	6.5	
00		2.2	1.0	3.8	
0 0	-18		_	-	
00	-15	4.5	0.6	9.2	
		1.9	2.3	9.8	
11//	12	0.9	0.6	7.5	
1///	- 6	0.1	0.7	1.4	
1///	4	0.0	0.0	0.0	
1//	_	0.8	0.4	1.6	
	0				

-21-

4.

High Raw Water Turbidity
with
Polymer as a Filter Aid

Oct. 24, 1972 Oct. 25, 1972

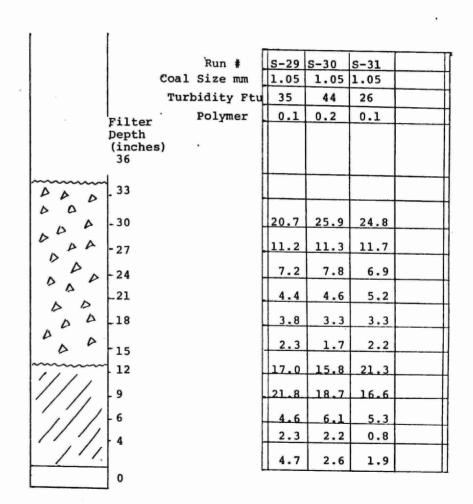
APPENDIX 6

	1	,	-				MEERINDIA O										LIMINGILL	/a-t	
Date	Run #	Temp O _F	l ——		r Medi		Filtration Rate	·				Floce	culation	Head Ft	~	Run Length	Total Filtered	Head Lo	
	"	F	San		Coal			Alum	Poly	Raw	Eff.		T		r	being cir	rirered	Distric	oution
			Depth	Eff.	Depth	Eff	IGPM/ft ²	ppm	ppm	FTU	FTU	H	Time	Final			Imp.	Coal	Sand
			in.	mm	11 .				*	**		G -1	min.		Through	Hours	Imp. Gal/ft ²	%	8
						1						G Sec-1							
Oct 24	s-29	50	12	0.45	20	0.9	6	10	0.10	35	0.25	20	14.5	8	8	8.1	2,900	75	25
		709 209	13	0.45	21	1.0	6	10	0.10	35	0.25	20	14.5	6,5	6.5	8.2	2,950	50	50
			12	0.45	20	1.5	6	10	0.10	32	0.32	20	14.5	4.5	4.5	5.6	2,000	37	63
Oct 24	s-30	50	12	0.45	20	0.9	6	10	0.20	44	0.35	20	14.5	8	_	5.5	2,000	83	17
			13	0.45	21	1.0	6	10	0.20	44	0.35	20	14.5	8	-	7.3	2,650	55	45
		, un	12	0.45	20	1.55	6	10	0.20	44	0.60	20	14.5	5.5	5.5	5.0	1,800	34	66
Oct 25	s-31	50	12	0.45	20	0.9	4	10	0.10	26	0.19	20	14.5	8	-	13.2	3,150	78	22
			13	0.45	21	1.0	4	10	0.10	26	0.20	20	14.5	8	_	16.2	3,900	54	46
			12	0.45	20	1.55	4	10	0.10	28	0.25	20	14.5	5	5	10	2,400	49	51
Y .																			
							.5.		*	Sepa	ran NP	10 rbidity	,						-23-
MOE 08-1	14 6-74	ı ·																	٣

Appendix 6

S-29 S-30 S-31 Run # 0.9 10.9 Coal Size mm 0.9 Turbidity Ftu 26 35 44 0.1 0.2 0.1 Polymer Filter Depth Headloss (inches) 36 33 55.5 64.4 12.0 27 8.9 51.3 8.9 _24 5.1 7.8 6.2 21 4.6 2.8 2.5 18 1.9 1.7 2.3 15 3.3 2.3 3.1 9.3 14.3 11.6 1.3 3.6 4.4 2.8 1.6 0.8 1.9 1.0

Appendix 6



Appendix 6

Run # Coal Size mm Turbidity Ftu	1					
Coal Size mm Turbidity Ftu Polymer Filter Depth Headloss (inches) % 36 37.4 4.4 6.8 11.2 11.2 14.7 A D D 21 A D		Run #	S-29	S-30	S-31	
Filter Depth (inches) 36 33 DDDD 30 DDDD 27 DDD 24 DDD 24 DDD 21 DDD 38 5.4 6.2 5.9 18 DDD 12 18.2 13.8 12.9 20.7 21.8 18.9 9.5 12.1 9.9 5.4 3.7 5.5 3.6 3.9 4.0		Coal Size mm				
Filter Depth Headloss (inches) 36 33 DDDD 30 T.4 4.4 6.8 11.2 11.2 14.7 DDD 24 DDD 24 DDD 21 DDD 30 5.9 5.5 6.9 5.9 10.3 5.9 18.2 13.8 12.9 20.7 21.8 18.9 9.5 12.1 9.9 1.1 1.2 1.2 1.2 1.2 1.1 1.2 1.2 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3		Turbidity Ftu	32	44	18	
Depth (inches) 36 33 DDDD 30 T.4 4.4 6.8 11.2 11.2 14.7 DDDD 27 DDD 27 DDDD 27 DDD 27 DD 27 DD 27 DD 27 DD 27 DD 27		Polymer	0.1	0.2	0.1	
D D D D 30 7.4 4.4 6.8 D D D 27 11.2 11.2 14.7 D D D 24 6.8 7.1 8.6 D D 21 5.9 5.5 6.9 D D 18 5.4 6.2 5.9 D D 15 5.9 10.3 5.9 18 2 13.8 12.9 20.7 21.8 18.9 9.5 12.1 9.9 5.4 3.7 5.5 3.6 3.9 4.0		Depth Headloss (inches) %				
11.2 11.2 14.7 24 25 26 27 6.8 7.1 8.6 5.9 5.5 6.9 5.4 6.2 5.9 5.9 10.3 5.9 18 10 11 11 11 11 11 11 11 11		_ 33				
A 27 A 24 B 24 B 21 B 5.9 5.4 6.2 5.9 10.3 5.9 10.3 5.9 10.3 12 18.2 13.8 12.9 20.7 21.8 18.9 9.5 12.1 9.9 5.4 3.7 5.5 3.6 3.6 3.9	DDD	- 30	7.4	4.4	6.8	
24 21 5.9 5.5 6.9 5.4 6.2 5.9 5.4 6.2 5.9 5.9 10.3 5.9 11 12 18.2 13.8 12.9 20.7 21.8 18.9 9.5 12.1 9.9 5.4 3.7 5.5 3.6 3.9 4.0	000	- 27	11.2	11.2	14.7	
5.4 6.2 5.9 5.9 10.3 5.9 12 18.2 13.8 12.9 20.7 21.8 18.9 9.5 12.1 9.9 5.4 3.7 5.5 3.6 3.9 4.0	DDD	- 24	6.8	7.1	8.6	
18 15 12 12 18 19 10.3 5.9 18.2 13.8 12.9 20.7 21.8 18.9 9.5 12.1 9.9 5.4 3.7 5.5 3.6 3.9 4.0	1	- 21	5.9	5.5	6.9	
15 5.9 10.3 5.9 18.2 13.8 12.9 20.7 21.8 18.9 9.5 12.1 9.9 9.0 9	1	. 18	5.4	6.2	5.9	
12 18.2 13.8 12.9		. 15	5.9	10.3	5.9	
9.5 12.1 9.9 5.4 3.7 5.5 3.6 3.9 4.0		- 12	18.2	13.8	12.9	
5.4 3.7 5.5 3.6 3.9 4.0	1////	- 9	20.7	21.8	18.9	
3.6 3.9 4.0	1///	- 6	9.5	12.1	9.9	
3.6 3.9 4.0	1///	- 4	5.4	3.7	5.5	
	1///	[3.6	3.9	4.0	

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High Raw Water Turbidity Polymer with as a Filter Aid

Feb. 6, 1974 Feb. 7, 1974 Feb. 8, 1974

Ontario

Ministry of the Environment

APPENDIX 7

Date	Run #	Temp o _F	F		Coal	a	Filtration Rate		icals		oidity Eff.	Floca	ulation	Head Ft		Run Length	Total Filtered	Head Lo	
		1			Depth	Eff	IGPM/ft ²	ppm		FTU x	FTU	G Sec	Time	Final	Break Through	Hours	Imp. Gal/ft ²	Coal %	Sand %
Feb 6	67	33	13	0.45	22	0.9	4	18	0.11*	32	0.23	20	28	7.0	7.0	9.3	2,250	76	24
			13	0.45	22	1.05	4	19	0.11*	32	0.23	20	28	7.0	7.0	8.8	2,100	55	45
	•		13	0.45	22	1.55	4	19	0.11*	32	0.23	20	28	5.4	5.4	7.5	1,800	44	56
Feb 7	68	33	13	0.45	22	0,9	4	18	0.105	* 30	0.19	20	28	8	-	3.0	700	96	4
			13	0.45	22	1.05	4	18	0.105	* 31	0.21	20	28	8	-	4.4	1,050	94	6
			13	0.45	22	1.55	4	18	0.105	* 30	0.19	20	28	8	-	5.7	1,350	95	5
			*															198.15	
Feb 8	69	33	13	0.45	22	0.9	4	18	*** 0.10	31	0.16	20	28	8	7	10.2	2,450	68	32
			13	0.45	22	1.05	4	18	0.10	31	0.18	20	28	5,6	5.6	10.0	2,400	53	47
			13	0.45	22	1,55	4	18	0.10	31	0.16	20	28	6,1	6.1	10.0	2,400	43	57
							* Separa	n NP1	5										
							** Purifi	oc N2)							-			
							*** Nalcol	yte 8	171										
			,				x artifi	cialt	urbidi	ty ad	ded to	raw.							-27-
MOE 08-1	14 6-7	4 :									l		İ			11	11	1	

Appendix 7

1						
-	Run #		67	68	69	
ბ	oal Size mm		0.9	0.9	0.9	
*	Separan		0.11	0	0	
Filter	Purifloc	L	0	0.105	0	
Depth (inches)	Nalcolyte		0	0	0.10	
35	Headloss %					
D D D 33	*		24.4	83.7	19.0	
D D 30			25.7	11.4	21.6	
D 27			13.8	0.4	12.5	
D D -24			6.4	0.0	6 • 8	
D 21			3.2	0.0	4.5	
D D 18			1.7	0.2	2.8	
A A -15			1.2	0.2	1.6	
-12			4.7	0.9	9.5	
///-9			9.5	0.7	14.6	
////-6			4.5	0.5	6.5	
//// 4		-	2.7	0.7	0.2	-
			2.2	1.3	0.4	
0						

kun #	67 68 69	1
Ċoal Size mm	1.05 1.05 1.05	
Separan	0.11 0 0	
Purifloc	0 0.105 0	\prod
Filter Nalcolyte	0 0 0.10	
(inches) Headloss		
D D P 33	14.1 60.0 9.7	
D D D 30	17.9 32.1 12.6	
D D D 27	11.6 0.8 10.8	П
D D D	5.0 0.2 8.3	П
D D -24	2.9 0.0 4.1	Ħ
D D 21	2.3 0.2 4.3	
D D -15	1.0 0.6 3.0	Ш
12	13.0 0.0 15.8	Ц
//// 9	17.1 2.5 11.6	
////-6	8.4 2.4 9.6	
1///4	3.1 0.4 4.3	Ц
/////	3.6 0.8 5.9	
0		

Appendix 7

1 1	-
Run	# 67 68 69
Coal Size	mm 1.55 1.55 1.55
Separan	0.11 0 0
Purifloc	0 0.105 0
Filter Nalcolyte	e 0 0 0.10
(inches) Headle	oss
36 °	
A A 33	4.4 16.9 3.2
D D 30	9.5 51.9 6.7
27	7.5 23.2 6.4
D A -24	6.1 1.8 4.9
D D 21	4.6 0.5 5.7
A A -18	5.7 0.3 7.3
A A -15	6.6 0.9 8.8
12	18.9 0.8 15.9
/////-9	15.9 1.1 18.7
////-6	9.4 0.9 10.3
///-4	5.3 0.5 6.0
////	6.1 1.2 6.1
0	

APPENDIX 8

DIRECT FILTRATION

Omano ,			,				APPENDIX O	·				,				DIRECT	FILTRATIO	NA .	
Date	Run #	Temp °F	Filter		r Media Coal		Filtration Rate	Chemicals Alum Poly			Flocculation				Run Length	Total Filtered	Head Loss Distribution		
				tion and the same of			IGPM/ft ²	ppm		FTU			Time		Break Through			Coal	Sand
			in.	mm		mm				*		G Sec	min.		22049		Gal/ft ²	8	ૠ
July 31	30	68	13	0.45	22	0.9	6	6	0	1.5	0.3	20	14.5	8	-	16.5	5,950	78	22
	ţ		13	0.49	22	1.05	6	6	0	1.5	0.3	20	14.5	8	-	16	5,750	48	52
	•		13	0.45	22	1.55	6	6	0	1.5	0.3	20	14.5	8	-	22	1,900	27	73
							pH = 7.0											*	
July 30	29	67	13	0.45	22	0.9	6	6	0	1.5	0.23	20	14.5	8	-	22	7,900	78	22
			13	0.45	22	1.05	6	6	0	1.5	0.25	20	14.5	8	-	27	9,700	48	52
			13	0.45	22	1.55	6	6	0	1.5	0.25	20	14.5	8	-	31	11,150	30	70
							рн = 7. 85												
									-										
										*	Natura	1							
																			<u>.</u>
MOE 08-1	14 6-7	4																	-31-

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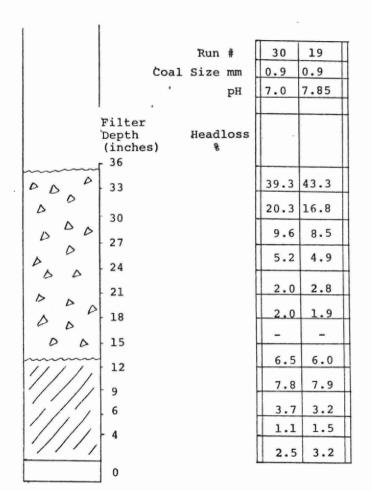
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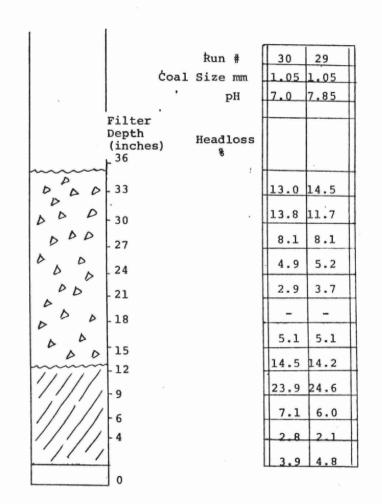
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Appendix 8
HEADLOSS DISTRIBUTION RESULTS

Appendix 8
HEADLOSS DISTRIBUTION RESULTS





I	ľ					
			Run	#	30	29
		Ċoal	Size	mm	1,55	1.55
				рН	7.0	7.85
	 Filter	•				
	Depth (inche:	s)	Head:	loss		
000	33				7.3	9.3
D D D	- 30				7.6	7.7 .
DD					5.2	5.3
DA	- 27				3.8	4.7
A D A	21				3.3	2.8
0	- 18				-	_
AAA					13.0	12.1
A B A	15				31.8	32.3
1///	. 9	*			15.8	14.0
1///	- 6				6.5	5.7
1///	4				1.2	1.6
////					4.5	4.5
i	10					

-33-

Various Alum Dosages

at a

Filtration Rate of 4 Igpm/sq ft

Sept. 27, 1972 Sept. 25, 1972 June 13, 1972 Oct. 16, 1972 Aug. 21, 1972

APPENDIX 9

DIRECT FILTRATION

Date	Run #	Temp o _F			r Medi		Filtration Rate		icals		oidity	Floca	culation	Head Ft		Run	Total Filtered	Head Lo	
		F	San Depth		Coal	_	IGPM/ft ²	ļ	Poly		Eff.			Final	Break	20119 011		Coal	Sand
1			in.	EIL	1 .		IGPM/It	ppm	ppm	FTU *	FTU	G _1	Time		Through	Hours	Imp. Gal/ft ²	8	8
						1		-				G Sec-1	min.						
Sept 27	s-12	63	12	0.45	20	0.9	4	3.8	0 .	2.3	0.25	20	14.5	8	_	39	9,350	88	12
			12	0.45	21.5	1.0	4	3.8	0	2.3	0.25	20	14.5	3.7	-	48	11,500	61	39
	•		12	0.45	20	1.5	4	3.8	0	2.3	0.25	20	14.5	3.2	-	48	11,500	38	62
Sept 25	s-11	63	12	0.45	20	0.9	4	6.5	0	0.7	0.16	20	14.5	8	-	28	6,700	92	8
			12 .	0.45	21.5	1.0	4	6.5	0	0.7	0.16	20	14.5	8	-	38	9,100	67	33
			12	0.45	20	1.5	4	6.5	0	0.7	0.16	20	14.5	8	-	34.5	8,300	68	32
June 13	s-2	50	12	0.45	25	1.0	4	10	0	3.5	0.15	20	14.5	8	-	16.2	3,900	87	13
			12	0.45	20	1.3	4	10	0	3.5	0.15	20	14.5	6	6	17.5	4,200	57	43
			12	0.45	20	1.55	4	10	0	3.5	0.15	20	14.5	5	5	17	4,100	53	47
Oct 16	S-22	54	12	0.45	20	0.9	4	15	0	20	0.18	20	14.5	6	6	11.5	2,750	74	26
			12	0.45	21	1.0	4	15	0	20	0.18	20	14.5	4.5	4.5	11.5	2,750	54	46
			12	0.45	20	1.55	4	15	0	20	0.20	20	14.5	3	3	7.2	1,750	42	58
Aug 21	s-9	66	12	0.45	20	0.9	4	40	0	0.8	0.10	20	14.5	7	7	8	1,900	82	18
			12	0.45	22	1.0	4	40	0	0.8	0.10	20	14.5	5	5	7.7	1,850	52	48
			12	0.45	20	1.5	4	40	0.35	0.8	0.10	20	14.5	7	7	8	1,900	48	52
										*	Natura	1 .							-35-
MOE 08-1	14 6-7	4			I						Į.		1		The state of the s				

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Appendix 9

HEADLOSS DISTRIBUTION RESULTS

Run # s-12 s-11 S-22 0.9 Coal Size mm 0.9 Alum mg/l 3.8 Turbidity Ftu 2.3 6.5 10 15 40 3.5 20 0.8 Filter Depth Meadloss (inches) 36 _33 54.6 78.4 64.5 41.8 51.0 10.0 16.6 24 6.8 22.4 9.3 6.5 -21 5.9 6.2 -18 0.7 -15

3.2

5.9

3.3

1.4 27.7 13.8

3.3

3.9 12.2

2.7

4.9

3.3

2.3

11.6

6.1

Appendix 9

1 1						
R	un #	S-12	s-11	S-2	S-22	S-9
Coal S	ize mm	1.0	1.0	1.0	1.0	1.0
Alum	mg/1	3.8	6.5	10	15	40
Turbidi	ty Ftu	2.3	0.7	3.5	20	0.8
Filter Depth (inches)	eadloss					
33						
0 0 0 30		43.1	36.7		27.8	29.8
A D D D- 27		7.5	11.9	79.6	9.0	10.5
D D 24		4.2	7.7	3.9	6.8	5.5
5 b - 21		2.4	4.9	2.0	4.8	2.6
0 0 18		1.5	3.6	0.6	3.1	2.1
D D D 15		2.4	1.9	1.2	2.5	1.9
12		7.8	16.2	5.0	18.9	19.1
///// 9		14.7	10.9	4.9	14.7	13.0
/////6		6.9	2.6	1.6	5.3	5.6
////4		3.9	0.9	0.5	2.7	5.1
1////		5.6	2.7	0.7	4.4	4.8
0						

	Run #	s-12	s-11	S-2	S-22	S-9
	Coal Size mm	1.55	1.55	1.55	1.55	1.55
	Alum mg/l	3.8	6.5	10	15	40
	Turbidity Ftu	2.3	0.7	3.5	20	0.8
	Filter Depth (inches) 36 Headloss		8			
	- 33					
DDD	- 30	14.6	14.1		7.6	11.7
DD	27	7.8	17.2	•	10.9	14.9
0 0	24	4.1	11.8	37.6	7.3	7.5
	-21	4.4	9.6		6.1	5.1
DPD	-18	2.7	6.8	9.0	5.2	3.7
D D	-15 -	4.8	8.5	6.5	4.9	5.1
A A	-12	21.4	9.6	12.7	18.6	10.0
1////	-9	21.8	13.4		21.0	23.5
1///	-6	7.2	5.9	26.1	9.5	9.6
1///	-4	2.7	1.9		5,2	4.2
1///	0	8.5	1.2	8.1	3.7	4.7

Various Alum Dosages at a Filtration Rate of 6 Igpm/sq ft

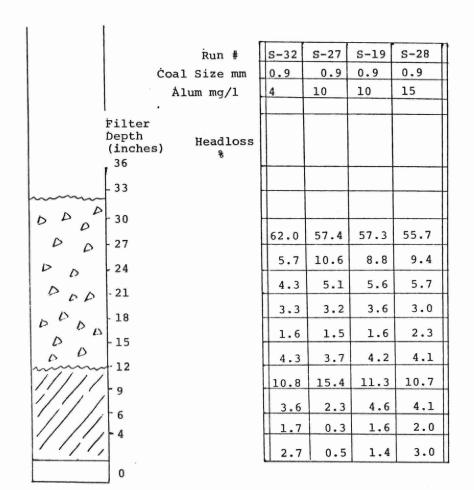
Oct. 30, 1972 Oct. 19, 1972 Oct. 11, 1972 Oct. 20, 1972 Environment

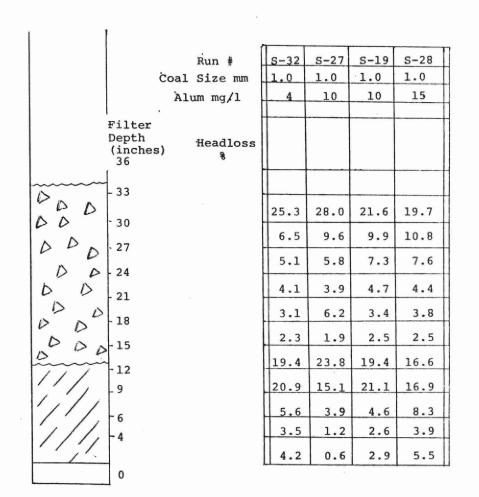
APPENDIX 10 DIRECT FILTRATION

Ontano ,	,						APPENDIX TO									21100	LILLIKALIC	121	
Date	Run #	Temp			Media	a	Filtration Rate		icals		idity	Floce	ulation	Head Ft		Run Length	Total Filtered	Head Lo	
	"	°F	San		Coal			Alum	Poly	Raw	Eff.		·		T	Leng ch	rircered		
			Depth	Eff	Depth	Eff	IGPM/ft ²	ppm	ppm.	FTU	FTU		Time	Final	Break Through	Hours	Imp. Gal/ft ²	Coal	Sand
			in.	mm	1 .				3	*		G Sec-1	min.		Inrough	nours	Gal/ft ²	%	8
Oct 30	5−32	47	12	0.45	20	0.9	6	4	0	1.5	0.18	20	14.5	8	. =	18	6,500	77	23
•			13	0.45	21	1.0	6	4	0	1.5	0.18	20	14,5	8	-	27	9,700	46	54
			12	0.45	20	1.55	6	4	0	1.5	0.25	20	14.5	8	-	28	10,050	28	72
Oct 19	5-27	48	12	0.45	20	0.9	6	10	0	4.5	0.25	20	14.5	8	-	12.2	4,400	78	22
			13	0.45	21	1.0	6	10	0	4.5	0.25	20	14.5	6.7	6.7	12.2	4,400	55	45
			12	0.45	20	1.55	6	10	0	4.5	0.25	20	14.5	4.5	4.5	8	2,400	40	60
Oct 11	S - 19	57	12 (.45	20	0.9	6	10	0	8	0.16	50	14	8	-	11.5	4,150	77	23
			13 (.45	21	1.0	6	10	0	8	0.15	50	14	7.5	7.5	12	4,300	49	51
			12 (.45	20	1.55	6	10	0	8	0.18	50	14	5.5	5,5	9	3,250	40	60
							d												
Oct 20	5-28	48	12 (.45	20	0.9	6	15	0	4.5	0.15	20	14.5	8	8	8.8	3,200	76	24
			13 (.45	21	1.0	6	15	0	4.5	0.15	20	14.5	5.5	5,5	6.2	2,250	49	51
			12 (.45	20	1.55	6	15	0	4.5	0.20	20	14.5	4.8	4.8	6.0	2,150	38	62
										*	Natura	1				.			-39-
MOE 08-] 114 6-7	4																	

Appendix 10
HEADLOSS DISTRIBUTION RESULTS

Appendix 10
HEADLOSS DISTRIBUTION RESULTS





1 1	1					
		Run #	S-32	S-27	S-19	S-28
	Ćoal	Size mm	1.55	1.55	1.55	1.55
	Àlı	um mg/l	4	10	10	15
	Filter Depth (inches) .36	Headloss %		,		
ABO	-33					
0 0	-30		4.8	6.9	6.8	5.2
DA	-27		6.2	8.5	8.3	9.5
000	- 24		3.9	6.5	6.0	6.5
00	-21		3.7	5.4	5.8	5.0
DO	- 18		3.7	4.7	5.7	4.6
00	-15		5.9	7.7	7.6	7.1
000	-12		25.0	24.0	15.7	21.0
	-9		23.4	22.8	25.0	20.8
1///	- 6		10.8	7.6	9.9	9.1
////	- 4		5.5	3.1	5.8	5.6
1///			7.1	2.8	3.4	5.6
1	0					

Appendix 11

The Influence of Low Algae Levels
on
Filter Performance

May 28, 1973 July 16, 1973

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APPENDIX 11

DIRECT FILTRATION

Ontano ,							APPENDIX II									DIRECT	FILTRATIC)IN	
Date	Run #	Temp o _F			r Medi Coal		Filtration Rate					Floca	ulation	Head Ft	1	Run Length	Total Filtered	Head Lo	
		F	San Depth		Depth	Eff	IGPM/ft ²	ppm	Poly	Raw FTU	FTU	C	Time	Final	Break Through			Coal	Sand
			in.	mm	in.	mm				*		G Sec-1	min.				Gal/it	95	69
1ay 28	4	48	13	0.45	22	0.9	4	6	0	0.85	0.20	20	14.5	8		25.5	6,100	86	14
			13	0.45	22	1.05	4	6	0	0.85	0.19	20	14.5	8	-	37.5	9,000	55	45
	•		13	0.45	22	1.55	4	6	0	0.85	0.24	20	14.5	8	-	45.5	11,000	30	70
	3																		
uly 16	24	65	13	0.45	22	0.9	4	6	0	0.9	0.22	20	14.5	8		40	9,600	71	29
			13	0.45	22	1.05	4	6	0	0.9	0.21	20	14.5	8	-	43	10,500	40	60
			13	0.45	22	1.55	4	6	0	0.9	0.27	20	14.5	8	-	50	12,000	26	74
										*	Natur	al							
															2				
								.											
1																			
																			a ji
MOE 08-1	114 6-7	4				P													

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Appendix 11
HEADLOSS DISTRIBUTION RESULTS

Appendix 11
HEADLOSS DISTRIBUTION RESULTS

1				
		Run #	4	24
	Co.	al Size mm	0.9	0.9
	,	*	 	<u> </u>
	Filter Depth (inches)	Headloss		
	35		H	
DDD	33		57.0	30.9
DD	30		14.7	20.0
0 0	-27		6.0	10.0
Δ Δ	24		3.6	5.0
DD	21		2.5	3.6
D D	-18		1.0	2.5
0 0	15		1.1	
7777	12		4.2	8.6
1////	9		0.4	8.6
1////	.6		5.1	5.4
1///	-4		2.6	2.5
11/1	0		1.8	2.9

1	1				
		Run		4	24
	Ċo	al Size m	nm _	1.05	1.05
			L		
	Filter		-	-	
	Depth (inches)	Headlo	oss		
	136	•	-		
DDD	33			25.9	16.3
DA	-30			10.0	9.2
0 0				8.9	4.3
000	27		ľ	3.8	3.9
DAD	24				
DDD	21		H	2.8	1.4
0 00	18		-	2.4	
000	15		L	1.3	4.9
in finn	12			19.8	20.6
	.9		ŀ	15.2	22.4
1/1/	-6		L	5.5	8.2
////	4		L	2.0	3.9
////				2.4	4.9
	0			ł	

Appendix 11

1	1		-			
		Run	# [4	24	
	Co	al Size	mm.	1.55	1.55	
						-
	Filter Depth (inches)	Head?	loss			
	36		-			-
DDD	33		-	8.7	5.6	4
D .				6.1	8.6	
000	50			4.6	4.5	
000	27					H
DDD	24		ŀ	4.0	3.3	H
0 0	21]	3.0	3.7	Ц
1 1	18			3.7	-	
DA				8.2	16.3	
0 0	15					T
1111	12			31.4	22.9	H
1///	.9			17.8	16.3	+
	6			7.0	11.4	1
1///	4			2.3	2.9	1
///	_			3.2	4.5	
	0					

-45-

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Ferric Chloride

Oct. 24, 1973 Oct. 23, 1973 Oct. 22, 1973

APPENDIX 12 DIRECT FILTRATION

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Omano ,							APPENDIX IZ									Direct	TIDITATIO	114	
Date	Run #	Temp O _F			r Medi		Filtration Rate		icals			Floce	ulation	Head Ft		Run Length	Total Filtered	Head Lo	
		F	San		Coal		IGPM/ft ²	Alum	Poly ppm	Raw	Eff. FTU		Time	Final	Break	-		Coal	Sand
1973			in.	mm	1 -		10211/10	Ppm	pp			G Sec-1			Through	Hours	Imp. Gal/ft ²	%	ક
Oct24-5	51	57	13	0.45	22	0.9	4	1.75	0	1.0*	0.16		14.5	8	-	20	4,800	86	14
			13	0.45	22	1.05	4	1.75	0	1.0	0.13	20	14.5	8	-	28.8	6,900	62	38
			13	0.45	22	1.55	4	1.75	0	1.0	0.13	20	14.5	8	-	28	6,700	`53 -	47
Oct 23	49	57	13	0.45	22	0.9	4	4.0	0	6.5*	0.18	20	14.5	8	-	12.8	3,100	94	6
			13	0.45	22	1.05	4	4.0	0	6.5	0.18	20	14.5	8	-	18	4,300	74	26
	9		13	0.45	22	1.55	4	3.7	0	6.5	0.16	20	14.5	8	-	17	4,100	70	30
Oct 22	48	57	13	0.45	22	0.9	4	4.3	0	3 *	0.14	20	14.5	8	-	13	3,100	90	10
			13	0.45	22	1.05	4	4.3	0	3	0.14	20	14.5	8	-	16.5	4,000	76	24
			13	0.45	22	1.55	4	4.3	0	3	0.16	20	14.5	8	-	14.5	3,500	69	31
Oct 24	50	57	13	0.45	22	0.9	4	6.7	0	17**	0.18	20	14.5	8	-	9.5	2,300	97	3
			13	0.45	22	1.05	4	6.7	0	17	0.22	20	14.5	8	-	12.5	3,000	81	19
-			13	0.45	22	1.55	4	6.7	0	17	0.16	20	14.5	8	-	11.8	2,800	67	33
												Turbi ity ad	dity ded to r	aw water	c	-			-47-
MOE 08-		74															\		

Appendix 12
HEADLOSS DISTRIBUTION RESULTS

Appendix 12

1	i							
		Rur	n #	51	49	48	50	T
	Ċ	oal siz	e mm	0.9	0.9	0.9	0.9	Ī
		FeCl3	(mqq)	1.75	3.7	4.3	6.7	I
	Filter Depth (inches)	Неа	dloss					
D	- 33			47.3	53.9	49.9	32.5	
DD	30		,	24.5	25.4	28.7	39.4	
D D D	- 27			8.4	9.6	7.6	15.4	
00	24			3.4	2.7	1.9	5.7	
D D	- 21			1.8	0.9	1.0	2.7	
DO	18			0.7	1.0	0.8	0.9	
DDD	- 15			-	-			H
	12		,	3.9	2.1	0.2	1.5	
1///	9			4.8	2.0	1.3	0.8	
1///	- 6			3.4	1.0	4.8	0.7	
1///	- 4			0.0	0.6	2.3	0.4	
////				1.8	0.8	1.5	0.0	
	0							•

	1				
	Run #	51	49	48	50
**	Coal Size mm	1.05	1.05	1.05	1.05
	FeCl ₃ (ppm)	1.75	4.0	4.3	6.7
	Filter Depth Headloss (inches) %				
D D	- 33	27.6	31.7	18.2	29.3
D D	- 30	14.5	20.7	20.3	25.3
DDD	27	10.5	10.3	12.0	13.1
DD	- 24	4.3	5.8	7.9	7.2
DDD	- 21	2.4	3.1	5.6	3.1
D	- 18	<u> </u>		5.3	-
D D D	- 15	2.5	2,7	6.3	3.2
~~~~	12	17.8	14.5	13.9	11.2
////	9	13.1	7.2	4.4	5.6
1/1/	- 6	3.4	2.0	1.4	1.1
1///	+4	2.5	0.7	1.9	0.4
////		1.4	1.3	2.8	0.5
	0				

Appendix 12

		1			-				
			R	ın #	51	49	48	50	1
		C	oal Si	ze mm	1.55	1.55	1.55	1.55	1
		×	FeCl ₃	(ppm)	1.75	4.0	4.3	6.7	
		Filter Depth (inches)	Hea	adloss %					
	DDD	- 33			12.7	14.6	18.2	9.0	I
	DD	-30			15.0	22.2	20.3	23.2	
	D D	-27			8.0	12.6	12.0	13.9	
	D D	- 24		;	5.7	8.5	7.9	7.2	
	DDD	-21			5.2	6.7	5.6	5.3	
	D D	-18			6.8	5.7	5.3	9.0	
	DDD	-15			12.2	6.6	6.3	9.4	
	7777	-12			18.8	15.4	13.9	15.9	
		9			8.4	4.9	4.4	4.6	
	////	6			2.9	1.3	1.4	1.2	
	////.	-4			2.0	0.3	1.9	1.3	Ц
	////				2.3	1.2	2.8	0.0	
1		0					array and a second		-

Cationic Polymers

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Primary Coagulants

July 4, 1973 July 19, 1973 July 24, 1973 Aug. 29, 1973 Sept. 3, 1973

APPENDIX 13

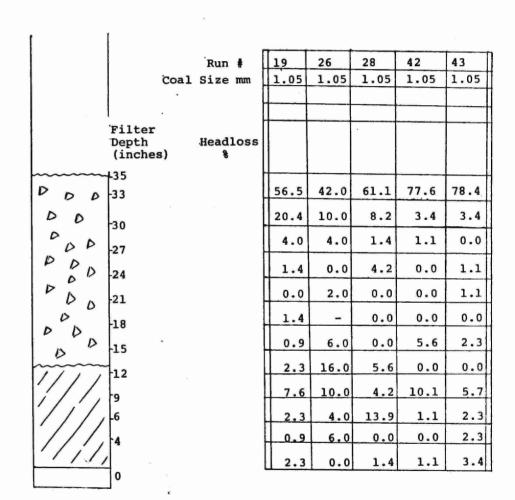
DIRECT FILTRATION

. Omano							APPENDIX 13									DIRECT	. ribiratic	VIA	
Date	Run #	Temp O _F	-		r Medi		Filtration Rate		icals		bidity	Floce	ulation	Head Ft		Run Length	Total Filtered	Head Lo	
		l r	San		Coal		TODY (5, 2		Poly	H				Final	Break			Coal	Sand
×.			in.	mm	1 .		IGPM/ft ²	mqq	ppm.	FTU *	1	G Sec	Time min.		Through	Hours	Imp. Gal/ft ²	%	Ş
July 4	19	53	13	0.45	22	0.9	4	0	0.2	1,3	0.43		14.5	6,1	-	50	12,000	97	3
-			13	0.45	22	1.05	.4	0	0.2	1.3	0.5	20	14.5	3	-	50	12,000	84	16
	,		13	0.45	22	1.55	4	0	0.2	1.3	0.5	20	14.5	2.1	•	50	12,000	67	33
July19	26	65	13	0.45	22	0.9	4	0	0.4	1.7	0.8	20	14.5	2.0	-	23.5	5,650	91	9
			13 -	0,45	22	1.05	4	0	0.4	1.7	0,9	20	14.5	1.5	-	23.5	5,650	58	42
			13	0.45	22	1.55	4	0	0.4	1.7	0.9	20	14.5	1.4	-	23.5	5,650	44	56'
July24	28	68	13	0.45	22	0.9	4	0	0.4	1.8	0.6	20	18	1.3	-	73	17,500	91	9
			13	0.45	22	1.05	4	0	0.4	1.8	0.6	20	18	1.2	-	73	17,500	75	25
			13	0.45	22	1.55	4	0	0.4	1.8	0.65	20	18	0.8	-	73	17,500	61	39
Aug 29	42	70	13	0.45	22	0.9	4	0	0.2-	0.8	0.45	550	11	2.6	-	43.5	10,450	93	7
			13	0.45	22	1.05	4	0	0.2-	0.8	0.45	550	11	1.6	-	43.5	10,450	82	18
Sept. 3	43	70	13	0.45	22	0.9	4	0	0.3	1.1	0.48	20	18	2.3	-	21	5,050	91	9
			13	0.45	22	1.05	4	0	0.3	1.1	0.45	20	18	1.5		21	5,050	84	16
			13	0.45	22	1.55	4	0	0.3	1.1	0.50	20	18	1.5	-	21	5,050	74	26
-										*	Natura	1							
							, v			**	Nalcol	yte 81	)1			,			-51-
MOE 08-	114 6-7	4																	,

Appendix 13
HEADLOSS DISTRIBUTION RESULTS

Appendix 13

Run #	19	26	28	42	43
Coal Size mm	0.9	0.9	0.9	0.9	0.9
Nalcolyte 607	0.2	0.4	0.4	0.3	-
Nalcolyte 8101				-	0.3
Filter Depth Headloss (inches) %					
D D D - 33	41.8	83.6	76.7	86.5	85.4
. 30	52.5	6.4	7.0	3.8	3.1
D D D - 27	1.0	0.0	4.7	2.2	0.6
	0.5	0.9	1.2	0.5	1.8
	0.0	0.0	0.0	0.0	0.0
	0.7	0.0	1.2	0.0	0.0
D D 18	0.2	_	0.0	0.0	0.0
15	1.0	3.7	3.5	0.0	0.0
//// 9	0.0	1.8	1.2	2.7	6.1
1///6	1.0	2.7	1.2	2.7	1.8
1///4	0.3	0.9	1.2	1.1	0.6
1///	1.0	0.0	2.1	0.5	0.6
0					



I	1					
*	-	Run #	19	26	28	43
	Coal	Size mm	1.55	1.55	1.55	1.55
		*	-			
	Filter		1			
	Depth (inches)	Headloss				
A D D	+ 35 _ 33.		38.0	28.9	48.5	63.0
ADD	- 30	=	17.1	11.2	3.0	7.3
00	27		5.4	0.0	0.0	1.9
DD	24		3.8	2.2	3.0	0.0
DD	21		1.6	2.2	6.1	1.9
DD	18		0.8	-	0.0	0.0
0	- 15		7.8	15.5	12.1	7.3
PD	12		11.6	15.5	0.0	14.8
1///	- 9		6.9	4.5	6.1	0.0
1///	- 6		3.8	20.0	12.1	0.0
1///			1.6	0.0	0.0	1.9
////	4		1.6	0.0	9.1	1.9

Flash Mix Study

Aug. 18, 1973 Aug. 14, 1973 Aug. 20, 1973 Aug. 21, 1973

APPENDIX 14 DIRECT FILTRATION

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Untario							APPENDIX L	4								DIREC	r FILTRATIC	/N	
Date	Run #	Temp o _F			r Medi		Filtration Rate			-		Flood	ulation	Head Ft		Run	Total Filtered	Head Lo	
		F	San	d	Coal			Alum	Poly	Raw	Eff.			1			1111111		
			Depth in.	Eff.	Depth in.		IGPM/ft ²	ppm	ppm	FTU		G Sec -1	Time min.	Final	Break Through	Hours	Imp. Gal/ft ²	Coal %	Sand %
Aug 18	37	67	13	0.45	22	0,9	6	6	0	1.5*			14.5	8	-	23.5	8,450	81	19
*			13	0.45	22	1,05	6	6	0	1.5	0.20	20	14.5	8	-	27	9,700	54	46
			13	0.45	22	1.55	6	6	0	1.5	0.20	20	14,5	8	-	29	10,450	40	60
Aug 14	35	67	13	0.45	22	0.9	6	5.5	0	1,5*	0.16	20	14.5	8	-	24	8,650	83	17
			13	0.45	22	1.05	6	5.5	0	1.5	0.20	20	14.5	8	-	29	10,450	56	44
			13	0.45	22	1.55	6	5,5	0	1,5	0,16	20	14.5	8	-	31	11,150	39	61
Aug 20	38	71	13	0.45	22	0.9	4	10	0	12**	0.12	20	18	8	₹*	19	6,850	93	7
			13	0.45	22	1.05	4	10	0	12	0.17	20	18	8	-	23	8,300	62	38
			13	0.45	22	1.55	4	10	0	12	0.12	20	18	8	<u> </u>	23.5	8, 450	43	57
											-								
Aug 21	39	71	13	0,4	22	0,9	4	10	0	12**	0.23	20	18	8		19	6,850	90	10
			13	0.45	22	1.05	4	10	0	12	0.23	20	18	8	-	25	9,000	69	31
			13	0.45	22	1.55	4	10	0	12	0.23	20	18	8	•	24.5	8,800	40	60
MOE 08 -	114 6-7	74								1	atura urbidi	1 2	ed to ra	w water					· - 55-

Appendix 14

HEADLOSS DISTRIBUTION RESULTS

Appendix 14

1		_			
	Run #	37	35	38	39
	Coal Size mm	0.9	0.9	0.9	0.9
	Flash Mix	-	NO		NO
	Filter			<del></del>	
	Depth (inches) Headloss				
	r 36 %				
D D D	- 33	44.6	42.9	38.6	38.4
DDD		17.9	19.1	29.6	29.1
0	30	10.8	10.5	13.7	12.1
DDD	27	3.3	5.5	6.9	6.5
	- 24	2.1	3.2	3.2	2.5
DD	21	2.0	1.8	0.8	1.2
00	18		_	_	_
DD	- 15	H			
7//	12	4.9	3.5	0.7	2.2
1////	- 9	5.0	5.3	2.1	4.3
1///	- 6	2.6	2.6	3.9	1.5
V///,	. 4	3.8	0.9	0.3	0.9
///	<u>,                                    </u>	3.0	4.7	0.2	1.3
	0				

1						
		Run #	37	35	38	39
	Ċoal	Size mm	1.05	1.05	1.05	1.05
1	Flas	h Mix		NO		NO
De	lter epth inches)	Headloss %				
D D	36		24.9	25.3	19.9	26.0
	33		14.9	14.6	20.3	23.8
DDD	30		8.2	8.6	12.5	10.2
DDD	27 24		4.7	5.8	1.8	6.0
DD	21		1.5	2.1	7.3	3.1
DDD	18			_	-	-
DDD	15		5.6	3.7	3.5	2.2
	12		14.9	13.5	21.6	8.5
1///	9		14.8	19.9	9.5	11.0
1///	.6		8.6	3.2	1.8	2.4
1///	4		0.2	1.8	1.1	1.4
1/1			1.7	1.5	0.7	5.4
	0					

Appendix 14

1 1 .				
'Run #	37	35	38	39
Coal Size mm	1.55	1.55	1.55	1.55
Flash Mix	<b> </b>	NO		NO
Filter Depth (inches)				
D D 33	11.4	12.1	13.2	11.0
D 20	10.4	9.5	12.1	11.5
D 27	6.9	7.3	8.6	8.4
D D 24	6.9	5.5	5.6	5,3
D 21	4.2	4.6	3.5	4.1
D 0 -18	-	_	-	
D D 15	22.9	19.1	10.8	9.1
12	21.6	19.3	29.8	27.8
9	9.8	13.0	11.1	13.5
-6	2.0	6.3	4.1	6.3
///4	1.8	2.0	0.4	0.6
///	2.1	1.3	0.8	2.4

Flocculation Velocity Gradient

Oct. 2, 1972 Oct. 5, 1972 Oct. 3, 1972 Oct. 10, 1972

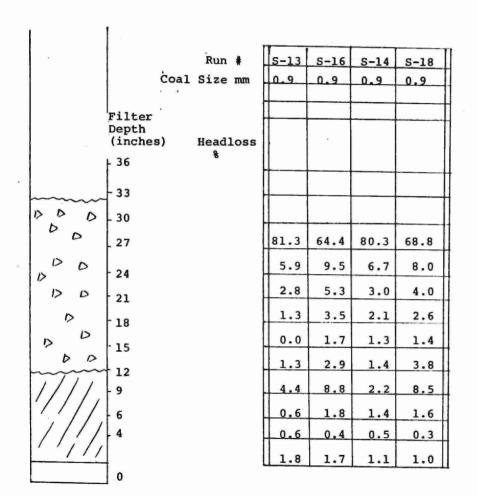
APPENDIX 15

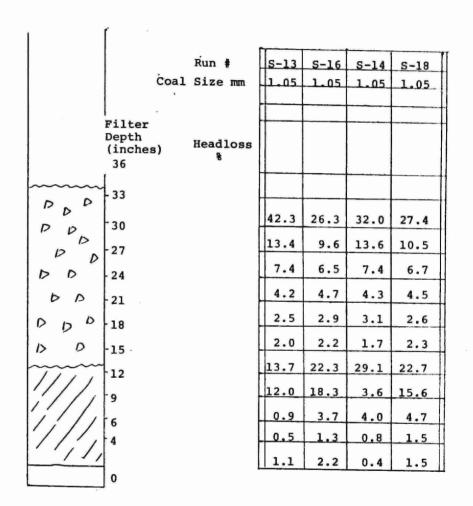
DIRECT FILTRATION

- Cinano							APPENDIX 15									DITACC	r rrmrwirt	)TA	
Date	Run #	Temp O _F	San	<del></del> ,	r Medi Coal		Filtration Rate	<u> </u>	Poly			Floce	culation	Head Ft		Run Length	Total Filtered	Head Lo	
		F		Eff.		Eff	IGPM/ft ²	ppm		FTU	FTU	G Sec-1	Time	Final	Break Through	Hours	Imp. Gal/ft ²	Coal	Sand %
Oct 2	S-13	60	12	0.45	20	0.9	6	10	ρ	0.8	0.17		14.5	8	-	9	3250	91	9
			13	0.45	21	1.05	6	10	o	0.8	0.18	20	14.5	8	-	13	4700	72	28
	•		12	0.45	20	1.55	6	10	0	0.8	0.18	20	14.5	8	-	13	4700	42	58
Oct 5	s <b>-</b> 16	60	12	0.45	20	0.9	6	10	0	0.7	0.10	50	14	8	-	10.5	3800	84	16
			13	0.45	21	1.05	6	10	0	0.7	0.10	50	14	8	-	13	4700	52	48
			12	0.45	20	1.55	6	10	o	0.7	0.10	50	14	8	-	12.5	4500	33	67
0c <del>t 3</del>	S-14	60	12	0.45	20	0.9	6	15	0	0.8	0.10	20	14.5	8	_	7	2500	93	7
			13	0.45	21	1.05	6	15	o	0.8	0.11	20	14.5	8	-	9.7	3500	62	38
-			12	0.45	20	1.55	6	15	o	0.8	0.13	20	14.5	8	-	9	3250	42	58
Oct 10	S-18	57	12	0.45	20	0.9	6	15	0	1.5	0.10	50	14.5	8	-	7	2500	85	15
				0.45		1.05			o		0.10	1	14.5	8	-	9	3250	54	46
3 .			12	0.45	20 .	1.55	6	15	o	1.5	0.10	50	14.5	7	7	8	2900	34	66
					,			×		*Nat	ural								-59-
MOE 08-	114 6-7 114 11	4									ļ								a

Appendix 15
HEADLOSS DISTRIBUTION RESULTS

Appendix 15
HEADLOSS DISTRIBUTION RESULTS





1 1						
		Run #	S-13	S-16	S-14	s-18
		Size mm	1.55	1.55	1.55	1.55
			-			
	Filter Depth (inches) 36	Headloss %		: ·		
	. 33					
DDDD	- 30		10.3	6.6	12.5	9.6
D	- 27		14.2	8.6	12.2	8.9
DDD	. 24		9.9	6.3	7.4	6.4
DD	- 21		0.5	6.2	5.6	4.9
	- 18		7.3	5.3	4.6	4.0
DD			8.1	7.8	4.7	6.6
DD	15		14.6	18.0	23.1	25.2
7///	12 . 9		22.4	25.8	21.8	21.2
1///	. 6		8.2	8.5	5.3	7.0
1///.	4		3.4	3.7	1.9	3.6
////	7	e	1.1	3.2	0.9	2.6
	0					

Flocculation Velocity Gradient

Oct. 29, 1974 Oct. 30, 1974 Oct. 31, 1974

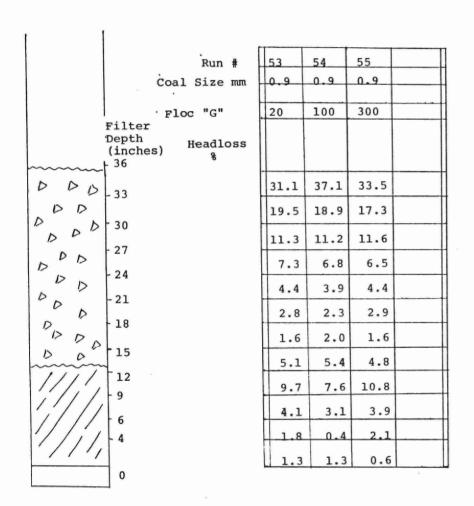
.

DIRECT FILTRATION

Omario		1,					WESTUDIY T	6						<del></del>		7	LIDINALLO	741	
Date	Run #	Temp O _F	F San		r Medi Coal		Filtration Rate					Floce	culation	Head Ft		Run Length	Total Filtered	Head Lo	
			1				IGPM/ft ²		Poly		Eff. FTU		mi	Final				Coal	Sand
			in.	mm	0 .		IGPM/IC	ppm	ppm	FTU *	1 1	G Sec ⁻¹	Time min.		Through	Hours	Imp. Gal/ft ²	8	8
ct 29	53	55	13	0.45	22	0.9	4	12	ρ	16	0.14		14.5	8	-	16.0	3850	78	22
			13	0.45	22	1.05	4	12	o	16	0.15	20	14.5	6	6	14.5	3500	59	41
_			13	0.45	22	1.55	4	12	o	16	0.13	20	14.5	6	6	13,5	3250	34	66
												,							
ct 30	54	55	13	0.45	22	0.9	4	12	o	12.5	0.14	100	14.5	8	-	15	3600	82	18
			13	0.45	22	1.05	4	12	0	12.5	0.13	100	14.5	6	6	16.5	3950	65	35
			13	0.45	22	1.55	4	12	o	12.5	0.15	100	14.5	6	6	13.5	3250	32	68
ct 31	55	55	13	0.45	22	0.9	4	12	0	14	0.14	300	14.5	7.3	7.3	17.0	4100	78	22
			13	0.45	22	1.05	4	12	0	14	0.15	300	14.5	4.5	4.5	13	3100	56	44
			13	0.45	22	1.55	4	12	0	14	0.15	300	14.5	4.5	4.5	11.5	2750	29	71
										* Tuz	bidit	added	to raw					,	*
						1													
MOE 08-	114 6-2	74 :									İ		i	1		11			

Appendix 16
HEADLOSS DISTRIBUTION RESULTS

Appendix 16



	Run #	53	54	55	
	Coal Size mm	1.05	1.05	1.05	
		-			
	Filter Floc "G"	20	100	300	
	Depth (inches) Headloss %				
	35	-			
DDDD	- 33	17.0	24.2	18.1	
DDD	-30	14.9	15.5	12.2	
D 1		9.4	8.9	8.0	
D	- 27	6.9	5.8	6.1	
DD	- 24	5.3	4.6	6.1	
AND	-21	3.4	3.1	3.3	
DDD	18	2.1	2.7	2.1	
0000	-15	<del> </del>			
	12	13.4	15.7	12.7	
1///	. 9	11.3	8.5	19.0	
1///	- 6	5.5	6.7	6.3	
7///	4	7.6	2.5	2.1	
1///		3.2	1.8	4.0	
	0				<u> </u>

Appendix 16

	Ť	1						
			Run #	53	54	5,5	1	$\neg$
		Ċoal	l Size mm	1.55	1.55			1
		Filter F	loc "G"	20	100	300	-	$\dashv$
		Depth (inches)	Headloss					
		<del>^</del> 35	<b>6</b>					-
	D .	-33		7.1	8.2	9.7		$\mathbb{H}$
	000	-30		11.2	11.3	7.9		Ш
	000	-27		8.8	7.4	7.2		
	NA D	-24		6.8	5.2	4.4		$\mathbb{I}$
	080	-21		7.8	5.6	5.0		7
	000	-18		7.0	6.7	3.7		$\prod$
	000	-15		8.5	7.9	6.8		bracket
	~~~~~	-12	<u> </u>	11.8	19.1	25.6		$ lab{I}$
	////	- 9		16.3	14.0	14.4		
	/////	_6		7.3	7.2	6.6		\prod
	1///	-4		4.1	4.4	5.9		\prod
-	////			3.3	3.0	2.8		
- 1		0						

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Flocculation Velocity Gradient

Nov. 2, 1974 Nov. 3, 1974 Nov. 5, 1974 Nov. 7, 1974

APPENDIX 17

DIRECT FILTRATION

	1		T				1 2 2 2 2 2 2 7 7			T		II		ir-				T	
Date	Run #	Temp O _F	Filter Media Sand Coal			Filtration Rate					Flocculation				Run	Total Filtered	Head Loss Distribution		
		F	-		Coal			Alum	Poly	Raw			T	Final	Break			Coal	Sand
			1	Eff.	18		IGPM/ft ²	ppm	ppm	FTU	FTU	G ,	Time		Through	Hours	Imp. Gal/ft ²	%	and &
			in.	mm	in.	mm			î.	*		G Sec-1	min.				Gai/IL	**	15
Nov 2	56	55	13	0.45	22	0.9	4	12	0	13	0.16		4.5	8	-	13.4	3200	90	10
			13	0.45	22	1.05	4	12	0	13	0.16	20	4.5	8	-	16.8	4050	59	41
			13	0.45	22	1.55	4	12	0.	1.3	0.16	20	4.5	8	_	15.5	3700	35	65
Nov 3	57	55	13	0.45	22	0.9	4	12	0	14	0.16	300	4.5	8	-	13.0	3100	86	14
			13	0.45	22	1.05	4	12	0	14	0.16	300	4.5	7.5	7.5	17.3	4150	62	38
			13	0.45	22	1.55	4	12	О	14	0.16	300	4.5	7.2	7.2	15.5	3700	32	68
Nov 5	58	53	13	0.45	22	0.9	4	12	o	15	0.16	20	28	7	7	14.0	3350	81	19
			13	0.45	22	1.05	4	12	0	15	0.17	20	28	4.7	4.7	,11.5	2750	58	42
			13	0.45	22	1.55	4	12	О	15	0.16	20	28	4.5	4.5	10.0	2400 .	29	71
_																			
Nov 7	60	50	13	0.45	22	0.9	4	12	0	15	0.14	300	28	6	6	13.0	3100	79	21
			13	0.45	22	1.05	4	12	0	15	0.14	300	28	3.6	3.6	12.0	2900	_56	44
			13	0.45	22	1.55	4	12	0	15	0.14	300	28	3.7	3.7	9.5	2300	70	30
		4								*	Tur	pidity	added to	raw					-67-
MOE 08 -	114 6-7	4															******		

Appendix 17
HEADLOSS DISTRIBUTION RESULTS

56 58 60 57 Run # 0.9 0.9 0.9 0.9 Coal Size mm Filter Depth (inches Headloss 34.2 41.2 37.6 43.7 21.0 21.7 17.3 16.3 11.2 12.4 8.8 9.7 27 5.3 6.3 6.6 8.2 3.2 4.3 4.2 4.8 - 21 -1.8 1.5 2.5 3.0 -18 1.3 1.7 1.9 3.2 - 15 5.0 3.7 3.5 2.6 6.8 3.4 8.0 8.0 6.1 2.3 4.5 0.7 0.5 2.0 0.0 2.3 3.1 0.9

Appendix 17

1				
Run #	56	57	58	60
'Coal Size mm	1.05	1.05	1.05	1.05
	-			
Filter Depth Headloss (inches)				
35 D D D -33	20.1	21.3	25.3	21.5
A -	14.3	15.8	13.1	12.5
D 30	8.0	8.8	5.6	7.9
D	6.6	6.5	6.2	4.6
D D D 24	4.8	3.7	3.9	3.8
D D -21	3.3	3.4	2.9	3.3
D D D 18	2.1	2.1	1.4	1.9
D D 15	14.0	7.7	13.4	16.3
//// 12	20.2	19.7	18.3	17.7
1//// 9	4.2	5.9	5.1	5.5
[///[6	1.2	2.4	1.5	2.5
////4	1.2	2.7	3.3	2.5
0	LI.			

Appendix 17

1 1				
Run #	56	57	58	60
Coal Size m	m 1.55	1.55	1.55	1.55
Filter				
Depth (INCHES) Headlos:	5			
35	-			
D D -33	6.8	9.0	9.7	37.6
D D D 30	13.8	10.2	8.1	16.3
D D -27	8.5	7.6	7.0	9.7
D D D 24	6.1	5.1	4.1	6.3
D P D -21	6.5	5.1	5.2	4.8
0 118	9.2	6.3	5.2	1.5
D D D 15	9.2	7.9	9.3	3.2
12	15.3	20.4	19.4	2.6
9	14.2	12.0	16.1	6.8
////6	7.2	8.6	7.4	6.1
1////4	2.3	4.0	3.8	2.0
11/11	0.9	3.8	4.7	3.1
1 0				

Flocculation Velocity Gradient Low Temperature

Jan. 28, 1974 Jan. 29, 1974



APPENDIX 18 DIRECT FILTRATION

<u>`</u> _	_						WELFURIY 18			_							TELLIMITO	1	
Date	Run #	Temp O _F			Medi		Filtration Rate					Floce	culation	Head Ft		Run Length	Total Filtered	Head Lo	
		F.	San		Coal		- 2 × 45. 2		Poly	I			Ī	Final	Brook			Coal	Sand
			in.		peptn in.		IGPM/ft ²	ppm	ppm	FTU	FTU	G _1	Time min.		Through	Hours	Imp. Gal/ft	8	8
										*		G Sec-1	III.II.						
ov 28	61	33	13	0.45	22	0.9	4	12	0	14	0.23	20	14.5	5.8	5.8	15.0	3600	71	29
			13	0.45	22	1.05	4	12	0	14	0.20	20	14.5	4.3	4.3	13.5	3250	57	43
			13	0.45	22	1.55	4	12	o	14	0.23	20	14.5	4.3	4.3	11.8	2850	37	63
v 29	62	33	13	0.45	22	0.9	4	12	0	14	0.22	300	14.5	6.0	6.0	10.8	2600	79	21
			13	0.45	22	1.05	4	12	o	14	0.22	300	14.5	4.3	4.3	9.0	2150	54	46
			13	0.45	22	1.55	4	12	o	14	0.23	300	14.5	4.3	4.3	7.5	1800	38	62
												1							
-										* Tr	ıbidit	addec	to raw						
														,					
																.			
 - MOE 08	 114 6-7	4 1				9					İ							1	

Appendix 18

Appendix 18
HEADLOSS DISTRIBUTION RESULTS

	Run #	61	62	61	6,2
	'Coal Size mm	0.9	0.9	1.05	1.05
	,				
	Filter				
	Depth Headloss (inches) %				
	35	25.7	30.8	21.7	20.0
DDD	- 33	+			20.9
DND	30	16.2	21.6	11.3	11.6
DD	27	12.1	11.3	6.9	7.4
DOD	- 24	8.8	8.0	5.8	5.3
DDD	- 21	3.5	4.0	5.5	3.8
DDD	- 18	4.4	1.3	3.2	3.0
DD	- 15	0.6	2.0	2.6	1.9
7777	12	7.5	1.5	19.1	16.1
1///	9	10.1	8.1	10.1	18.1
1///	- 6	3.7	6.1	6.6	6.5
1///	4	2.7	2.6	0.0	2.9
////		4.7	2.7	7.2	2.5
1	1 0				

ſ	1			
		Run #	61	62
	Coa	al Size mm	1.55	1.55
	Filter Depth (inches)	Headloss		
		ъ		
P	35 33		9.8	12.1
000			10.1	9.9
DDD	30		6.7	7.4
DD	- 27	*	4.5	4.6
000	24		5.6	4.3
DDD	- 21		1	
	18		5.9	5.3
000	. 15		11.0	9.6
			15.6	17.7
V.///.	- 12 9		14.9	13.6
V////	- 6		7.3	6.8
1////	4		3.3	4.0
1/1//	₫ *		5.3	4.7
	0			

Flocculation Velocity Gradient

Oct. 4, 1972 Oct. 6, 1972

4

Ministry of the Environment

APPENDIX 19

	,	· · · · · · · · · · · · · · · · · · ·	-				APPENDIX 15							-		Diluc.	FILLRATIO	***	
Date	Run #	Temp o _F	-		r Medi		Filtration Rate	l				Floca	culation	Head Ft		Run Length	Total Filtered	Head Lo	
		F	San Depth		Coal Depth		IGPM/ft ²	 	Poly	Raw FTU	Eff. FTU		Time	Final	Break		1	Coal	Sand
			in.	mm.	in.	mm				*		G Sec-1	min.	g u	Through	Hours	Imp. Gal/ft ²	ૠ	8
ct 4	s - 15	60	12	0.45	20	0.9	6	20	0	0.8	0.10	20	14.5	8	-	7	2500	82	18
			13	0.45	21	1.05	6	20	o	0.8	0.10	20	14.5	8	-	8	2900	56	44
	•		12	0.45	20	1.55	6	20	o .	0.8	0.10	20	14.5	7	7	7	2500	38	62
et 6	S-17	60	12	0.45	20	0.9	6	20	0	0.8	0.10	50	14	8		7	2500	78	22
				0.45		1.05			0		0.10		14	8	-	6.5	2350	50	50
			12	0.45	20	1.55	6	20	o	0.8	0.10	50	14	5.5	5.5	6	2150	32	68
						1				* Na	tural								
							.,	1											
		-													-				
	\parallel	•									•								
MOE 08-1	14 6-7	4 /																	

Appendix 19
HEADLOSS DISTRIBUTION RESULTS

S-15 S-17 Run # Coal Size mm 0.9 0.9 Filter Depth (inches) Headloss 33 30 65.9 61.2 27 8.0 5.8 24 3.8 5.6 21 2.8 3.3 18 1.6 15 1.9 3.0 3.6 12.0 12.8 4.4 0.2 0.6 0.0

Appendix 19
HEADLOSS DISTRIBUTION RESULTS

r f		
Ru	ın # [s-:	15 S-17
'Coal Si	ze mm 1.0	05 1.05
	-	
Filter Depth Hea (inches) %	dloss	
D D D 33		
DD 30	30.	0 25.0
D . 27	11	.2 12.0
D D 21	6	.0 5.8
D ~	4	.0 3.5
	H	.3 2.0
D D 18	T T	
D D D 15	H	.5 1.7
7/7/ 12	7	.8 15.0
////	30	.3 26.4
1///6	3	.6 3.8
1///4	1	.1 1.7
////	1	.2 3.1
0		

Appendix 19
HEADLOSS DISTRIBUTION RESULTS

	í	•			
•		Run #	_s-15	S-17	Τ
			1.55	1.55	t
					t
		Filter			
		Depth			I
		(inches) Headloss			ı
	1	1	-		L
	Burn	- 33			
	DDD	-30	9.6	9.2	
	100	-27	11.0	9.1	
	DOD	24	6.9	6.0	
	DA A.	-21	5.5	4.2	
	000	-18	5.0	3.6	
	D	-15	6.3	5.6	
	D D	-12	12.9	26.2	
	////	- 9	24.4	18.8	
	1/1/.	-6	9.6	7.9	1
	////	-4	6.6	5.0	
	////		2.2	4.4	
- 1		0			

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Flocculation Velocity Gradient 1973

June 20, 1973 June 25, 1973 Aug. 18, 1973 Aug. 7, 1973

-		***					WELDHOTY .							 	<u>, , , , , , , , , , , , , , , , , , , </u>		n ———		
Date	Run #	Temp o _F		-	r Medi		Filtration Rate		icals		idity	Floce	culation	Head Ft		Run Length	Total Filtered	Head Lo	70 (94)
		F	San Depth	Lancas and the same	Coal Depth		IGPM/ft ²	ppm	Poly	Raw	Eff. FTU	Tail C	Time	Final	Break Through		Tmn	Coal	Sand
			in.	mm	in.	mm				*		G Sec-1	min.				Gal/ft	8	8
June 20	14	50	13	0.45	22	0.9	4	6.2	o	1.5	0.16	20	14.5	8	_	21	5050	89	11
			13	0.45	22	1.05	4	6.2	ο	1.5	0.17	20	14.5	8	-	39.0	9350	55	45
	•		13	0.45	22	1.55	4	6.2	0	1.5	0.20	20	14.5	8	5	40	9600	- 27	73
June 25	16	55	13 .	0.45	22	0.9	4	6	o	1.2	0.16	50	14.5	8	-	23.5	5650	87	13
,			13	0.45	22	1.05	4	6	o	1.2	0.17	50	14.5	8	-	33	7900	56	44
	5		13	0.45	22	1.55	4	6	ó	1.2	0.17	50	14.5	8	6	36.5	8750	33	67
Aug 18	37	67	13	0.45	22	0.9	6	6	o	1.5	0.18	20	14.5	8	-	23.5	8450	81	19
			13	0.45	22	1.05	6	6	0	1.5	0.20	20	14.5	8	-	27	9700	54	46
			13	0.45	22	1.55	6	6	0	1.5	0.20	20	14.5	8	-	29	10,550	39	61
							3	. —		_			·					. ==	
Aug 7	32	68	13	0.45	22	0.9	6	6	0	1.2	0.23	100	14.5	8	-	26.5	9550	82	18
			13	0.45	22	1.05	6	6	0	1.2	0.23	100	14.5	8	-	34	12,250	49	51
			13	0.45	22	1.55	6	6	0	1.2	0.23	100	14.5	8	-	34	12,250	34	66
			×							* Na	tural					.			-78-
MOE 08-1	114 6-	74																}	~

Appendix 20

'HEADLOSS DISTRIBUTION RESULTS

Appendix 20

	Run #	14	16	37	32
1	Coal Size mm	0.9	0.9	0.9	0.9
	Floc "G"	20	50	20	100
Filter Depth (inches)	Headloss %			~	
D D D 30		70.1	59.9	44.3	54.2
D D -30		9.6	13.8	17.9	13.7
		4.1	6.0	10.8	6.6
D D 27	*	3.0	3.8	3.4	3.8
D D -21		1.4	2.2	2.1	2.1
		0.9	1.5	2.0	1.1
D D D 18		0.2	0.0	_	-
12		3.2	4.1	4.9	4.1
////		3.0	5.2	5.1	6.8
1///-6		1.6	1.5	2.6	3.4
////4		1.1	0.5	3.9	1.4
1///		1.8	1.5	3.0	2.8
0					

		Run #	14	16	37	32
	Coal	Size mm	1.05	1.05	1.05	1.05
		9				
	Filter		-			
,	Depth (inches)	Headloss				
	_35		10.0	27.4	24.0	70.0
DDD	- 33		19.8	27.4	24.9	19.8
D D	-30		14.8	11.8	14.9	12.9
D	-27		10.1	6.8	8.2	8.9
DD			4.9	4.6	4.7	5.8
DD	- 24		2.7	3.5	1.5	1.2
DD	-21		2.4	2.0	-	-
DD	- 18		2.0	1.7	5.6	8.3
D	-15		7.5	14.4	14.9	7.4
11/1	12		24.3	19.7	14.8	19.3
1///	9		6.0	4.2	8.6	7.6
1////	6		2.3	1.7	0.2	2.9
1///	4		3.2	2.2	1.7	5.9
	10		1			

	1							
			Run #	14	16	37	32	1
		'Coal	Size mm	1.55	1.55	1.55	1.55	
		L '						
		Filter Depth		-				1
			Headloss %					
	mmm	- 35		-				1
×	DDD	-33	y I	7.3	11.4	11.3	11.3	
	DDD	-30	ź.	7.3	7.7	10.3	8.0	I
	D	-27		4.6	5.8	6.8	5.7	
	DO	-24		3.9	4.7	6.8	4.7	
	O D	-21		3.5	3.6	4.2	4.2	
	DD	-18		4.5	3.8	-	-	
	DDD	-15		8.2	11.8	22.6	12.6	
		-12		25.9	25.1	21.3	22.3	
1	1///	-9		20.0	14.9	9.7	17.4	
	1///	-6		8.6	6.7	5.0	7.1	
	////	4		1.9	2.0	0.0	1.7	
	1/1	4	1	4.3	2.5	2.0	5.0	
- 1		0						

Flocculation Retention Time

Oct. 18, 1972 Oct. 20, 1972 Oct. 17, 1972 Ministry of the Environment

APPENDIX 21

- 11	#	o _F	San		r Medi Coal	a	Filtration Rate		icals			Floce	culation	Head Ft		Run Length	Total Filtered	Head Lo	
		F		200000000000000000000000000000000000000	Depth		IGPM/ft ²	ppm	ppm	Raw FTU	FTU	G Sec-1	Time min.	Final	Break Through		Two	Coal %	Sand %
Oct 18	s-26	54	12	0.45	20	0.9	6	15	О	7	0.18	20	8	8	-	8.7	3150	79	21
			13	0.45	21	1.0	6	15	o	7	0.18	20	8	8	-	10.0	3600	54	46
			12	0.45	20	1.55	6	15	о	7	0.18	20	8	.8	-	9.5	3400	33	67
Oct 20	s - 28	48	12 .	0.45	20	0.9	6	15	0	4.5	0.15	20	14.5	8	8	8.8	3150	76	24
•			13	0.45	21	1.0	6	15	o	4.5	0.15	20	14.5	5.5	5.5	6.2	2250	49	51
			12	0.45	20	1.55	6	15	o	4.5	0.20	20	14.5	4.8	4.8	6.0	2150	31	69
					w:														
Oct 17	5-24	54	12	0.45	20	0.9	6	15	o	19	0.2	20	14.5	5.6	5.6	5.8	2100	78	22
			13	0.45	21	1.0	6	15	0	19	0.21	20	14.5	4.0	4.0	5.2	1850	56	44
			12	o.45	20	1.55	6	15	0	19	0.25	20	14.5	3.0	3.0	3.6	1300	33	67
			,																
Oct 17	5-2	54	12	0.45	20	0.9	6	15	0	18	0.19	20	18	4.2	4.2	4.5	1600	69	31
			13	0.45	21	1.0	6	15	0	18	0.19	20	18	3.6	3.6	4.2	1500	51	49
,			12	0.45	20	1.55	6	15	0	18	0.23	20	18	2.5	2.5	2.8	1000	40	60
MOE 08-11										* Nat	ural	,		3					-82-

Appendix 21

		Run #	S-26	S-28	S-24	S-25
	Coal	Size mm	0.9	0.9	0.9	0.9
			-			
D	ilter epth inches)	Headloss				
	33					
	30					
DD	27		57.0	55.7	57.1	50.5
D	24		11.8	9.4	11.2	8.0
DDD	21		5.0	5.7	5.4	4.9
000	18		3.2	3.0	2.7	4.0
D	15		1.5	2.3	1.1	1.3
	12		3.7	4.1	3.4	5.2
	9		15.3	10.7	11.7	13.2
1///-	6		2.3	4.1	4.3	5.2
1 / / / / 1	4		0.2	2.0	1.1	3.1
1//	0		0.0	3.0	2.0	4.6

Appendix 21
HEADLOSS DISTRIBUTION RESULTS

,					*		
		Run #	Īs	5-26	S-28	S-24	S-25
	Coal	Size mm		1.0	1.0	1.0	1.0
			-				
Filter	, '		\parallel				
Depth (inche	es)	Headloss					
ŧ		,	1				
D D D - 33				29.0	19.7	27.5	27.0
D D 30			-	10.0	10.8	12.5	9.9
D D - 27				6.1	7.6	6.6	5.6
D D - 24			1	4.1	4.4	4.3	3,6
D D D - 21				2.6	3.8	2.3	2.4
D D 18				1.9	2.5	2.3	2.8
0 D D 15				24.7	16.	18.	5 18.4
////-12				15.7	16.	9 18.	5 19.9
1///-9				4.		3 3.	9 5.2
1////6				1.		1	9 2.8
1///-4				0.	6 5.	5 1.	7 2.
-//				1	9		

1 1						
	Run #	S-26	S-28	S-24	S-25	7
Coal	Size mm	1.55	1	1		1
	*:	·				1
Filter Depth		<u> </u>			 	4
	Headloss					1
	·	ļ				
33		-				
D D 30		7.2	5.2	7.8	7.1	
D D 27		8.8	9.5	8.1	12.3	I
		6.7	6.5	7.2	8.4	Ħ
$\begin{array}{c c} D & D & 24 \\ D & D & 21 \\ D & D & 10 \end{array}$		5.7	5.0	4.9	5.9	Ħ
D D - 18		5.0	4.6	5.2	6.5	П
D D - 15		7.2	7.1	6.5	5.2	H
12		23.8	21.0	25.2	14.3	
////-9		22.9	20.8	17.7	18.8	
1///6		6.7	9.1	8.2	10.4	
///-4	ļ	2.7	5.6	4.9	5.9	
////	. U	3.3	5.6	4.3	5.2	

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Flocculation Retention Time

Nov. 2, 1973 Oct. 29, 1973 Nov. 5, 1973

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Ministry of the Environment

APPENDIX 22

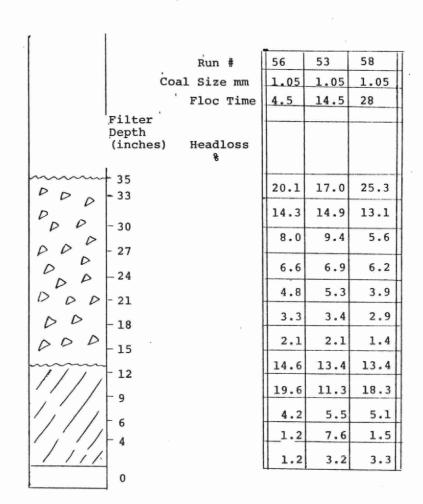
							THE L LINDER										TIBLIGHT		
Date	Run #	Temp o _F			r Medi		Filtration Rate					Floce	culation	Head Ft		Run Length	Total Filtered	Head Lo	
		F	San		Coal		. 2		Poly		Eff.			Final	Break			Coal	Sand
							IGPM/ft ²	ppm	ppm	FTU	FTU	G ,	Time		Through	Hours	Imp. Gal/ft ²	8	& Sand
,			in.	mm	in.	mm			,	*		G Sec-1	min.				341/10	•	*
Nov 2	56	55	13	0.45	22	0.8	4	12	0 .	13	0.16		4.5	8	-	13.4	3200	90	10
	,		13	0.45	22	1.05	4	12	o	13	0.16	20	4.5	8	-	16.8	4050	59	41
			13	0.45	22	1.55	4	12	o	13	0.16	20	4.5	8	-	15.5	3700	51	49
															ж.		,		
Oct 29	53	55	13	0.45	22	0.9	4	12	o	16	0.14	20	14.5	8	- 1	16.0	3850	78	22
		,	13	0.45	22	1.05	4	12	o	16	0.15	20	14.5	6	6	14.5	3500	59	41
			13	0.45	22	1.55	4	12	o	16	0.13	20	14.5	6	6	13.5	3250	49	51
Nov 5	58	53	13	0.45	22	0.9	4	12	0	15	0.16	20	28	7	7	14.0	3350	81	19
	,		13	0.45	22	1.05	4	12	0	15	0.17	20	28	4.7	4.7	11.5	2750	58	42
			13	0.45	22	1.55	4	12	0	15	0.16	20	28	4.5	4.5	10.0	2400	39	63
					n				*	Turbi	lity a	dded to	raw						
					2														
		,																	
																			-86-
MOE 08 -		4 !										÷			a				1

Appendix 22
HEADLOSS DISTRIBUTION RESULTS

Flocculation Time

Run # 58 Coal Size mm 0.9 0.9 0.9 Floc Time 4.5 14.5 28 Filter Depth Headloss (inches) 35 43.7 31.1 41.2 33 1> 21.0 19.5 17.3 D 30 11.2 11.3 8.8 27 6.6 7.3 5.3 24 4.2 4.4 21 2.5 2.8 1.8 18 1.3 1.6 1.9 15 5.1 5.0 3.5 12 9.7 3.4 8.0 0.7 4.5 0.5 0.9 1.3 2.3

Appendix 22



Appendix 22

1					
	Run #	56	53	58	
	Coal Size mm	1.55	1.55	1.55	
	Floc Time	4.5	14.5	28	
	Filter Depth (inches) Headloss				
P	133	6.8	7.1	9.7	
D	-30	13.8	11.2	8.1	
0	27	8.5	8.8	7.0	
D D	24	6.1	6.8	4.1	
_	-21	6.5	7.8	5.2	
0	-18	9.2	7.0	5.2	
D D	-15	9.2	8.5	9.3	
D D		15.3	11.8	19.4	
7//	12	14.2	16.3	16.1	
///	-6	7.2	7.3	7.4	
1///	4	2.3	4.1	3.8	
////	0	0.9	3.3	4.7	

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Flocculation Retention Time

Nov. 3, 1973 Oct. 31, 1973 Nov. 7, 1973 Ministry of the Environment

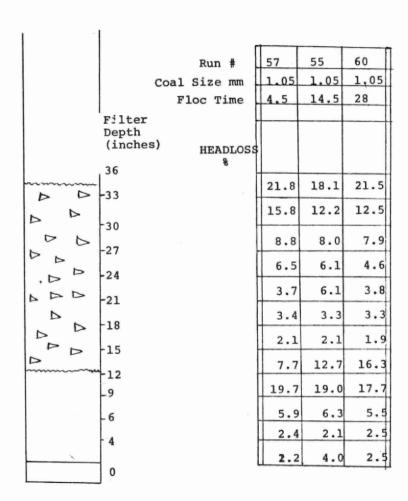
APPENDIX 23

							THI DINDIN							· -				,	
Date	Run #	Temp O _F	San		r Medi Coal		Filtration Rate		icals		eidity Eff.	Floca	culation	Head Ft		Run Length	Total Filtered	Head Lo	
		r'	1		Depth	Eff	IGPM/ft ²	 	ppm	FTU *	FTU	G Sec	Time		Break Through		Tmn	Coal %	Sand %
Nov 3	57	55	13	0.45	22	0.9	4	12	0	14	0.16		4.5	8	-	13.0	3100	86	14
			13	0.45	22	1.05	4	12	o	14	0.16	300	4.5	7.5	7.5	17.3	4150	62	38
			13	0.45	22	1.55	4	12	О	14	0.16	300	4.5	7.2	7.2	15.5	3700	37	63
et 31	55	55	13	0.45	22	0.9	4	12	0	14	0.14	300	14.5	7.3	7.3	17.0	4080	78	22
			13	0.45	22	1.05	4	12	0	14	0.15	300	14.5	4.5	4.5	13.0	3120	56	44
			13	0.45	22	1.55	4	12	0	14	0.15	300	14.5	4.5	4.5	11.5	2760	34	66
lov 7	60	50	13	0.45	22	0.9	4	12	0	15	0.14	300	28	6	6	13.0	3100	79	21
			13	0.45	22	1.05	4	12	o	15	0.14	300	28	3.6	3.6	12.0	2900	56	44
			13	0.45	22	1.55	4	12	0	15	0.14	300	28	3.7	3.7	9.5	2300	29	71
									*	Tur	bidity	added	to raw						
											,								
MOE 08-1	114 6-7	74													and the same of th				·

Appendix 23

57 Run # 55 60 Coal Size mm 0.9 0.9 0.9 Floc Time 14.5 28 Filter Depth Headloss (inches) 36 34.2 34.5 37.6 33 21.7 17.3 16.3 30 12.4 10.6 9.7 27 8.2 6.5 6.3 4.3 4.8 4.4 21 3.0 2.9 1.5 18 1.7 1.6 3.2 . 15 3.7 2.6 4.8 12 8.0 10.8 6.8 2.3 3.9 6.1 0.0 0.6 3.1

APPENDIX 23 HEADLOSS DISTRIBUTION RESULTS



APPENDIX 23
HEADLOSS DISTRIBUTION RESULTS

ı	1			
	Run #	57	55	60
	Coal Size mm	1.55	1.55	1.55
	Floc Time	4.5	14.5	28
	Filter			
	Depth (inches) Headloss			
	36			
PD	- 33	9.0	9.7	7.3
b b	,	10.2	7.9	8.1
A A A	- 30	7.6	7.2	5.6
ADA	- 27	5.1	4.4	4.4
DA	- 24	-		
D D D	- 21	5.1	5.0	4.0
A D A	- 18	6.3	3.7	4.2
D A D	15	7.9	6.8	9.7
D D	12	20.4	25,6	25.3
	- 9	12.0	14.4	15.4
	- 6	8.6	6.6	8.1
	- 4	4.0	5.9	3.2
		3.8	2.8	4.7
	0		_	

Flocculation Retention Time

Jan. 31, 1974 Jan. 28, 1974 Jan. 30, 1974 Feb. 4, 1974 Feb. 5, 1974

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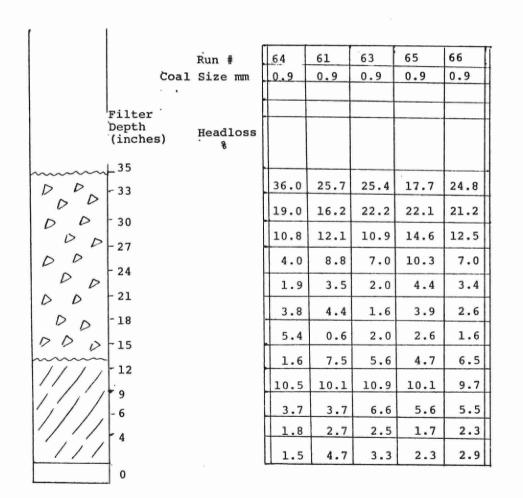
Ministry of the Environment

APPENDIX 24

Omano,		, , ,					APPENDIX 24							ir		DITUE	TIDIMIL	724	··
Date	Run #	Temp o _F	F San		Coal		Filtration Rate	-	Poly		Eff.	Floc	culation	Head Ft		Rụn Length	Total Filtered	Head Lo	
		F					IGPM/ft ²	ppm	ppm	FTU			Time	Final	Break Through	Hours	Imp.	Coal	Sand
			in.	mm					,	*		G Sec-1	min.				Gal/ft	8	8
n 31	64	33	13	0.45	22	0.9	4	12	o	11	0.20	20	4.5	8	-	18	4300	76	24
			13	0.45	22	1.05	4	12	0	11	0.20	20	4.5	6.2	6.2	17.3	4150	59	41
			13	0.45	22	1.55	4	12	0	11	0.20	20	4.5	6.3	6.3	15.3	3650	36	64
ın 28	61	33	13	0.45	22	0.9	4	12	o	14	0.23	20	14.5	5.8	5.8	15.0	3600	71	29
			13	0.45	22	1.05	4	12	o	14	0.20	20	14.5	4.3	4.3	13.5	3250	57	43
		*.	13	0.45	22	1.55	4	12	о	14	0.23	20	14.5	4.3	4.3	11.8	2850	37	63
n 30	63	33	13	0.45	22	0.9	4	12	o	13	0.20	20	28	4.2	4.2	10.5	2500	69	31
			13	0.45	22	1.05	4	12	o	13	0.20	20	28	2.8	2.8	9.5	2300	56	44
			13	0.45	22	1.55	4	12	o	13	0.20	20	28	3.0	3.0	8.0	1900	35	65
b 4	65	33	13	0.45	22	0.9	4	12	o	14	0.20	20	4.5	7.4	7.4	17.7	4250	73	27
			13	0.45	22	1.05	4	12	0	14	0.20	20	4.5	5.5	5.5	15.0	3600	57	43
			13	0.45	22	1.55	4	12	o	14	0.20	20	4.5	5.4	5.4	13.3	3200	32	68
b 5	66	33	13	0.45	22	0.9	4	12	o	14	0.18	20	28	4.0	4.0	11.0	2650	72	28
			13	0.45	22	1.05	4	12	0	14	0.20	20	28	3,1	3.1	9.5	2300	49	51
,_			13	0.45	22	1.55	4	12	0	14	0.20	20	28	3.1	3.1	7.8	1900	31	6 <u>9</u>
			¥							* tu	rbidit	, adde	d to raw						
MOE 08 -	114 6-7	74	-											,					

APPENDIX 24
HEADLOSS DISTRIBUTION RESULTS

APPENDIX 24
HEADLOSS DISTRIBUTON RESULTS



1			-				
	Run #	64		61	63	65	66
ico	oal Size mm	1	05	1.05	1.05	1.05	1.05
	38	-					
Filter Depth (inches)	Headloss						
D P 33		2	2.8	21.7	17.0	17.4	15.2
D D 30		1	2.7	11.3	13.1	15.8	14.3
D D 27			3.5	6.9	13.5	9.7	7.9
24		1	5.8	5.8	4.8	5.8	5.4
		-	3.5	5.5	3.5	4.1	2.5
D D 18		#	3.2	3.2	3.1	2.8	2.2
D D 15		1	2.3	2.6	1.3	1.7	1.8
12		1	3.4	19.1	12.2	13.0	18.5
//// 9		1	6.3	10.1	20.1	20.4	18.6
////6			5.5	6.6	5.2	5.2	7.5
///4		-	2.6	0.0	3.1	1.9	2.2
/ / /./			3.4	7.2	3.1	2.2	3.9
0							

	1							
		Run #		64	61	63	65	66
1	Co	al Size	mm	1.55	1.55	1.55	1.55	1.55
		•	-	-				
	Filter		-					
	Depth (inches)	Headl	oss			,		
James	- 35		-					
DDDD	_33		-	9.7	9.8	8.5	5.2	7.5
000	- 30		_	11.2	10.1	9.0	11.6	9.5
00	27			5.4	6.7	7.7	5.5	6.4
00	-24			5.2	4.5	4.7	5.0	4.3
D D	-21			4.8	5.6	4.7	4.8	3.2
000	_18			6.7	5.9	6.4	5.9	6.4
DD	-15			10.3	11.0	8.1	12.2	9.0
	_12			15.5	15.6	16.2	15.7	11.2
////	- 9	×	-	15.0	14.9	16.2	18.5	27.6
	-6		.	6.9	7.3	8.5	8.0	7.4
1///	_4		Н	6.0	3.3	5.6	3.8	4.3
////				3.3	5.3	4.4	3.8	3.2

APPENDIX 25 & 26

Low Temperature Filtration 1972

Feb. 15, 1972 Feb. 17, 1972 Feb. 22, 1972 Feb. 29, 1972 Mar. 1, 1972 Mar. 128, 1972 Apr. 3, 1972 Apr. 24, 1972

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							APPENDIA	1						it		11	TI	1	
Date	Run #	Temp o _F	-		r Medi Coal		Filtration Rate		icals		eff.	Floce	culation	Head Ft		Run Length	Total Filtered	Head Lo	
	ĺ	F	San				IGPM/ft ²		Poly ppm.	Raw FTU	FTU		Time	Final	1		Tmn	Coal	Sand
			in.	mm		1 1	IGFM/ IC	ppm	ppm	*		G Sec-1			Through	Hours	Imp. Gal/ft ²	8	96
eb 15	r-1	37	11	0.45	16	1.0	4	10	0.12	10	0.35	20	18	8	-	28.5	6850	58	42
			12	0.45	16	1.2	4	10	0.12	10	0.35	20	18	8	-	25.5	6100	52	48
	,		12	0.45	16	1.4	4	10	0.12	10	0.4	20	18	8	-	31	7450	50	50
			16	0.45	20	1.7	4	10	0.12	10	0.35	20 .	18	8	_	26	6250	22	78
eb 17	r-2	36.5	11 .	0.45	16	1.0	4	25	0.12	10	0.05	20	18	6	6	10.5	2500	64	3 6
			12	0.45	16	1.2	4	25	0.12	10	0.05	20	18	6	6	10	2400	54	46
	,		12	0.45	16	1.4	4	25	0.12	10	0.05	20	18	5.0	5.0	11	2650	60	40
			16	0.45	20	1.7	4	25	0.12	10	0.05	20	18	5.5	5.5	11	2650	39	61
eb 22 T	r-3	35.5	11	0.45	16	1.0	4	10	0.12	25	0.4	20	18	8	-	21	5050	59	41
			12	0.45	16	1.2	4	10	0.12	25	0.4	20	18	8		22	5300	58	42
			12	0.45	16	1.4	4	10	0.12	25	0.45	20	18	8	-	26	6250	55	45
			16	0.45	20	1.7	4	10	0.12	25	0.4	20	18	8	-	26	6250	28	72
eb 29 1	r-4	38	11	0.45	16	1.0	4	10	О	25	0.40	20	18	4.5	4.5	14	3350	57	43
			12	0.45	16	1.2	4	10	О	25	0.35	20	18	4.5	4.5	16	3850	38	62
1			12	0.45	16	1.4	4	10	0	25	0.45	20	18	4.0	4.0	12.5	3000	53	47
			16	0.45	20	1.7	4	10	0.110		0.35	1 1	18	8	-	20 .	4800	38	62
MOE 08-11	 4 6-7	4 '								* t	urhidi	ty adde	ed to ra						



-	T	1	11				HELENDIA 20	11		77				-		DIREC	T FILTRATIO	ON	
Dat	e Ru #	n Temp	Sar		r Medi Coal		Filtration Rate		Poly		bidity	Floc	culation	Head Ft		Run Length	Total Filtered	Head L	
	II.	1	1	T	Depth		IGPM/ft ²		+	11			T	Final	Break	1	11100100	Coal	
			in.	min			IGPM/IC	ppm	ppm **	FTU *		G Sec-1	Time min.		Through	Hours	Imp. Gal/ft ²	%	Sand %
Mar 2	T-5	37.5	11	0.45	16	1.0	4	15	0.1	50	0.5	20	18	5	5	14	3350	55	45
		-	12	0.45	16	1.2	4	15	0.1	50	0.4	20	18	5	5	12	29.00	·37	63
			12	0.45	16	1.4	4	15	0.1	50	0.5	20	18	3,8	3.8	13	3100	47	53
			16	0.45	20 .	1.7	4	15	0.1	50	0.5	20	18	6	6	16	3850	29	71
Mar 28	T-6	37	12	0.45	16	1.0	2	10	p	10	0.3	20	42	4.5	4.5	50	6000	61	39
			12	0.45	16	1.2	2	10	o	10	0.3	20	42	4.5	4.5	56	6700	55	45
			12	0.45	16	1.4	2	10	0	10	0.3	20	42	4.2	4.2	58	6950	57	43
			12	0.45	18	1.55	2	10	0	10	0.3	20	42	5.5	5.5	60	7200	42	58
'Apr 3	T-7	37	12	9.45	16	1.0	2	13	9.11	10	0.25	20	12	Q		56	6700	82	18
-			12	0.45	16	1.2	2	13	0.11				42	8	-		7450	70	30
			12	0.45	16	1.4	2	13	0.11	10	0.25	20	42	8	-	78	9350	70	30
general management and programme and program			12	0.45	18	1.55	2	13	0.11	10	0.25	20	42	8	-	68	8150	67	33
Apr 4	Ī-8	37	12	0.45	16	1.0	6	10	0.10	4	0.3	20	18	8	~	12.5	4500	64	36
· ·			12	0.45	16 1	2	6	10	0.10	4	0.3	20	18	8	Una	13.1	4700	52	48
Trees the contract of the cont			12	.45	18 1	.55	8	10	0.10	4	0.3	20	18	8	-	11.2	5350	40	60
								k	* Turb	idity paran	added	to ra	w	The state of the s					-99-
MOE 08	-114 6-	/4 :	10.7 A. 1		4.0							grand L	1425		A				About a face of that

Run # Coal Size mm Alum mg/l Turbidity Ftu	T-1	T-2	т-3	т-4	T-5
Alum mg/l		1.0			
	10		1.0	1.0	1.0
Turbidity Ftu	10	25	10	10	15
	10	10	25	25	50
Filter Depth Polymer	0.12	0.12	0.12	0	0.1
(inches) Headloss					
27			,		
26	17.6	14.0	16.8	23.9	15.8
20	29.5	39.0	32.4	22.0	27.4
14	10.4	11.2	9.5	11.4	11.5
8	25.5	21.7	23.5	25.2	26.0
3	13.0	11.7	13.7	13.4	13.5
	4 0	2.4	4.1	4.1	5.8
.::	Headloss 27 26 20	Headloss 8 13.0	Headloss 8 17.6 14.0 29.5 39.0 10.4 11.2 25.5 21.7 13.0 11.7	Headloss 8 17.6 14.0 16.8 29.5 39.0 32.4 10.4 11.2 9.5 14 25.5 21.7 23.5 13.0 11.7 13.7	Headloss 8 27 26 17.6 14.0 16.8 23.9 29.5 39.0 32.4 22.0 10.4 11.2 9.5 11.4 25.5 21.7 23.5 25.2 13.0 11.7 13.7 13.4

1 1				
	Run #	T-6*	T-7*	T-8**
	Coal Size mm	1.0	1.0	1.0
	Álum mg/l	10	13	10
Filter	Turbidity Ftu	10	10	4
Depth (inche	Polymer	0	0.11	0.10
	Headloss			
27				
		10.3	32.5	29.7
		39.3	41.3	25.6
D D D 20 D D D D D D D D D D D D D D D D		11.6	7.8	8.3
D D 14		24.9	15.8	20.8
8	·	11.6	1.6	13.3
////		2.3	1.0	2.3

- * Filtration Raté: 2 Igpm/sq ft
- ** Filtration Rate 6 Igpm/sq ft

APPENDIX 25-26

HEADLOSS DISTRIBUTION RESULTS

APPENDIX 26

		,	· r · · · · · · · · · · · · · · · · · ·				
		Run #	T-1	T-2	T-3	T-4	т-5
		Coal Size mm	1.2	1.2	1.2	1.2	1.2
		Alum mg/l	10	25	10	10	15
		Turbidity Ftu	10	10	25	25	50
	Filter Depth	Polymer	0.12	0.12	0.12	0	0.1
	(inches	Headloss					•
~~~~	28		16.1	28.5	30.0	13.5	13.8
			22.6	18.1	18.9	15.3	15.2
DDD	20		13.0	7.3	8.6	8.8	8.2
///	8		30.8	30.0	23.7	36.4	40.9
	3		14.4	12.6	15.2	19.3	17.0
////	3		3.1	3.5	3.6	6.7	4.9

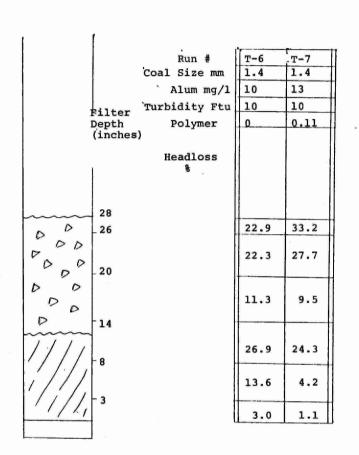
ĺ		<del></del>		,
	Run #	т-6*	T-7*	T-8**
1	l Size mm ,	1.2	1.2	1.2
- '	Alum mg/l	10	13	10
Turk	oidity Ftu	10	_10	4
Filter	Polymer	0	0.11	0.1
Depth (inches)	Headloss			
28				
DDD		16.9	39.7	30.6
D D D - 26 D D D - 20 D D D D		16.2	22.4	
D D D 14		22.1	7.5	6.5
7////-8		31.8	27.6	30.8
////-3		9.7	1.8	11.7
////		3.3	1.0	5.5

^{*} Filtration Rate 2 Igpm/sq ft

^{**} Filtration Rate 6 Igpm/sq ft

HEADLOSS DISTRIBUTION RESULTS

1						
	Run #	T-1	T-2	т-3	T-4	T-5
	Coal Size mm	1.4	1.4	1.4	1.4	1.4
	Alum mg/l	10	25	10	10	15
1	Turbidity Ftu	10	10	25	25	50
	Filter Polymer Depth	0.12	0.12	0.12	0	0.1
	(inches) Headloss					
DDD	28		,			
0	-26	22.2	30.2	31.4	27.8	20.7
DDD	-20	19.0	21.4	16.2	16.0	17.3
DDD	-14	9.2	8.7	7.5	9.3	8.9
////	_8	25.6	21.4	23.8	25.8	29.3
	-3	20.6	15.1	16.4	18.1	19.0
'//	*	3.4	3.2	4.7	3.0	4.8



APPENDIX 25-26

HEADLOSS DISTRIBUTION RESULTS

APPENDIX 26
HEADLOSS DISTRIBUTION RESULTS

	,					
	Run #	T-1	T-2	T-3	т-4	т-5
	Coal Size mm	1.7	1.7	1.7	1.7	1.7
	Alum mg/l	10	25	10	10	15
1	Turbidity Ftu	10	10	25	25	50
Filter Depth	Polymer	0.12	0.12	0.12	0.11	0.1
(inches						
36	Headloss	-				
D D _33	6	8.6	12.6	8.3	12.8	7.8
D D 30		4.4	9.6	5.9	9.1	6.4
D D 27		4.0	7.8	4.9	6.0	4.9
D D 24		2.8	4.9	3.9	4.4	3.9
D D 21		2.4	3.7	4.8	5.5	6.4
DD D -18		8.0	9.0	7.5	11.2	7.1
15		42.5	20.3	21.2	20.2	19.1
///_12		17.8	12.6	22.9	21.0	20.5
////9		4.7	9.4	9.9	3.7	9.7
///-6		2.4	5.3	5.7	2.6	6.5
///-4		1.1	2.8	2.3	1.4	3.5
///		1.3	2.0	2.7	2.1	4.2
0						

	I			40	
			,		
	,	Run #	T-6 *	T-7	T-8**
	Coal S	ize mm	1.55	1.55	1.55
	Alum	mg/l	10	13	10
	Filter Turbid	ity Ftu	10	10	4
	Depth Pol	ymer	0	0.11	0.10
	(inches)				
	H	eadloss	1 1		
		8			
	30				
. D D	27		17.7	32.4	12.1
DDO	T - '	Ì			
D D	- 24	-	10.2	15.3	5.2
	- 21		.7.6	9.2	7.4
DD	18		6.0	5.6	E 1
· D -	-10	ŀ		3.6	5.4
0 0 0	_15	1	5.8	4.9	10.4
0 0 0			12.4	15.4	18.2
1///	12		24.2		
////	- 9		24.3	13.8	18.2
1///	- 6		8.4	1.8	10.7
1///	4		.3.6	0.4	4.8
1////	1				
·		l.	4.0	1.2	7.6
	0				

^{*} Filtration Rate 2 Igpm/sq ft

^{**} Filtration Rate 8 Igpm/sq ft

Low Temperature Filtration 1974

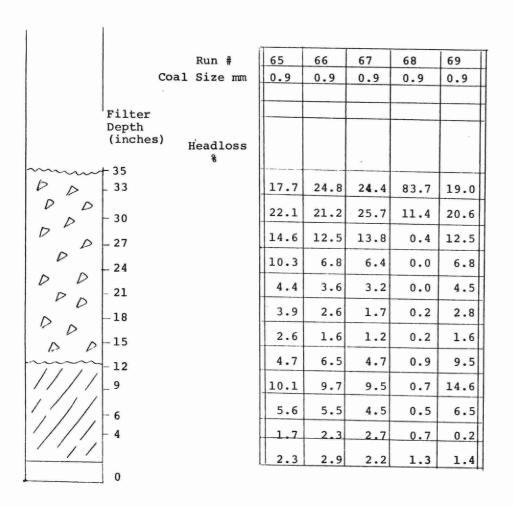
Feb. 4, 1974 Feb. 5, 1974 Feb. 6, 1974 Feb. 7, 1974 Feb. 8, 1974

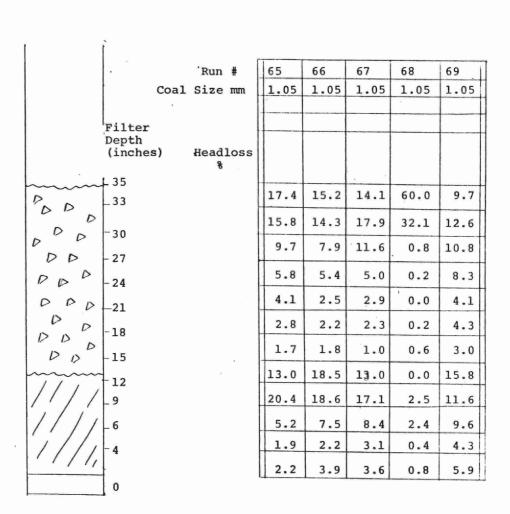
Ministry of the Environment

APPENDIX 27 DIRECT FILTRATION

Date	Run	Temp	F	ilte:	r Medi		Filtration Rate	Cher		Turl		Floce	culation	Head Ft		Run	Total	Head Lo	
	п	°F	San Depth in.				IGPM/ft ²	Alum	ppm	Raw FTU +	FTU	G Sec-1	Time	Final	Break Through	_	Filtered  Imp. Gal/ft	Coal %	Sand
eb 4	65	33	13	0.45	22	0.9	4	12	o .	14	0.20	20	4.5	7.4	7.4	17.7	4250	76	24
			13	0.45	22	1.05	4	12	0	14	0.20	20	4.5	5.5	5.5	15.0	3600	57	43
			13	0.45	22	1.55	4	12	0	14	0.20	20	4.5	5.4	5.4	13.3	3200	32	68
b 5	66	33	13	0.45	22	0.9	4	12	0	14	0.18	20	28	4	4	11.0	2650	73	27
			13	0.45	22	1.05	4	12	o	14	0.20	20	28	3.1	3.1	9.5	2300	49	51
			13	0.45	22	1.55	4	12	0	14	0.20	20	28	3,1	3.1	7.8	1900	31	69
b 6	67	33	13	0.45	22	0.9	4	19	0.105	32	0.23	20	28	7.0	7.0	9.3	2250	76 24	
			13	0.45	22	1.05	4	19	0.110	32	0.23	20	28	5.5	5.5	8.8	2100	55	45
			13	0.45	22	1.55	4	19	0.110	32	0.23	20	28	5.4	5.4	7.5	1800	32	68
b 7	68	33	13	0.45	22	0.9	4	18	0.105	*30	0.19	20	28	8	-	3.0	700	96	4
			13	0.45	22	1.05	4	10	0.105	*31	0.21	20	28	8	-	4.4	1050	94	6
			13	0.45	22	1.55	4	18	0.105	* 31	-0.19	20	28	8	-	5.7	1350	94	6
b 8	69	33	13	0.45	22	0.9	4	1	0.100		0.16	20	28	8+	-	10.2	2450	68	32
			13	0.45	22	1.05	4	18	0.100	* 31	0.18	20	28	5.6	5.6	10.0	2400	53	47
2			13	0.45	22 .	1.55	4	18	0.100	*31	0.16	20	28	6.1	6.1	10.0	2400	43	57
MOE 08-1	14 6-74	4						*Sepa NP10	ran	**	Purif.	loc N2	) ***Na]	colyte	8171 +	Turbidi	ty added to	raw	

APPENDIX 27





1								
			Run #	65	66	67	68	69
			Coal Size mm	1.55	1.55	1.55	1.55	1.55
		Filter						
		Depth (inches	Headloss					
		<b>⊢</b> 35	•					
	DDD	_ 3,3		5.2	7.5	4.4	16.9	3.2
3	DD	- 30		11.6	9.5	9.5	51.9	6.7
	DD	_ 27		5.5	6.4	7.5	23.2	6.4
	DD	24		5.0	4.3	6.1	1.8	4.9
	DDDD	21		4.8	3.2	4.6	0.5	5.7
	DD	- 18		5.9	6.4	5.7	0.3	7.3
-	DDD	_ 15		12.2	9.0	6.6	0.9	8.8
	سبب	. 12		15.7	11.2	18.9	0.8	15.9
	////	- 9		18.5	27.6	15.9	1.1	18.7
	1///	- 6		8.0	7.4	9.4	0.9	10.3
	////	4		3.8	4.3	5.3	0.5	6.0
	1///			3.8	3.2	6.1	1.2	6.1
		١.						

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Low Temperature Filtration 1974

Jan. 28, 1974 Jan. 29, 1974 Jan. 30, 1974 Jan. 31, **1**974

DIRECT FILTRATION

						REFERDIA							1				1	
Date   Run   #	Temp o _F			r Medi		Filtration Rate	ļ	icals	!		Floce	culation	Head Ft		Run Length	Total Filtered	Head Lo	
	F	San		Coal				Poly	11				Final	T	20119 011		Coal	Sand
		in.	EIL			IGPM/ft ²	ppm	ppm.	FTU *	FTU	G Sec-1	Time min.		Through	Hours	Imp. Gal/ft ²	8	8
00 41																		
n 28 61	33	13	0.45	22	0.9	4	12	0	14	0.23	20	14.5	5.8	5.8	15.0	3600	71	29
		13	0.45	22	1.05	4	12	0	14	0.20	20	14.5	4.3	4.3	13.5	3250	57	43
		13	0.45	22	1.55	4	12	0	14	0.23	20	14.5	4.3	4.3	11.8	2850	37	63
*											æ							
n 29 62	33	13 .	0.45	22	0.9	4	12	o	14	0.22	300	14.5	6.0	6.0	10.8	2600	77	23
		13	0.45	22	1.05	4	12	0	14	0.22	300	14.5	4.3	4.3	9	2150	54	46
		13	0.45	22	1.55	4	12	o	14	0.23	300	14.5	4.3	4.3	7.5	1800	38	62
n 30 63	33	13	0.45	22	0.9	4	12	0	13	0.20	20	28	4.2	4.2	10.5	2500	69	31
		13	0.45	22	1.05	4	12	0	13	0.20	20	28	2.8	2.8	9.5	2300	56	44
		13	0.45	22	1.55	4	12	0	13	0.20	20	28	3	3	8.0	1900	<b>3</b> 5	65
n 31 64	33	13	0.45	22	0.9	4	12	o	11	0.20	20	4.5	8+	-	18	4300	76	24
		13	0.45	22	1.05	4	12	0	11	0.20	20	28	6.2	6.2	17.3	4150	59	41
1		13	0.45	22	1.55	4	12	0	11	0.20	20	4.5	6.3	6.3	15.3	3650	36	64
									* tu	rbidit	y added	d to raw						

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APPENDIX 28

APPENDIX 28

		7-				
	Run #	61	62	63	64	
	Coal Size mm	0.9	0.9	0.9	0.9	
	Floc "G"	20	300	20	20	
Filte	r Floc Time	14.5	14.5	28	4.5	
Depth (inch						
D D -33		25.7	30.8	25.4	36.0	1
D D 30		16.2	21.6	22.2	19.0	
D 2 -27		12.1	11.3	10.9	10.8	
D -24		8.8	8.0	7.0	4.0	
D D -21		3.5	4.0	2.0	1.9	1
D D D -18		4.4	1.3	1.6	3.8	1
D D -15		0.6	2.0	2.0	5.4	1
12		7.5	1.5	5.6	1.6	1
///9		10.1	8.1	10.9	10.5	1
///-6		3.7	6.1	6.6	3.7	1
///4		2.7	2.6	2.5	1.8	1
		4.7	2.7	3.3	1.5	
0						

1					<u>*</u>
	Run #	61	62	63	64
Ċ.	oal Size mm	1.05	1.05	1.05	1.05
	Floc "G"	20	300	20	20
Filter	Floc Time	14.5	14.5	28	4.5
Depth (inches)	Headloss %				
D D 33		21.7	20.9	17.0	22.8
D D -30		11.3	11.6	13.1	12.7
D D 27	·	6.9	7.4	13.5	8.5
D D 24		5.8	5.3	4.8	5.8
D D 21	e su	5.5	3.8	3.5	3.5
D D 18		3.2	3.0	3.1	3.2
D D 15		2.6	1.9	1.3	2.3
12		19.1	16.1	12.2	13.4
//// 9 .		10.1	18.1	20.1	16.3
/// 6		6.6	6.5	5.2	5.5
1//4		0.0	2.9	3.1	2.6
. / / /		7.2	2.5	3.1	3.4
0					

<u> </u>					
	Run #	61	62	63	64
	coal Size mm	1.55	1.55	1.55	1.55
	Floc "G"	20	300	20	20
Filter	Floc Time	14.5	14.5	28	4.5
Depth (inches)	Headloss %				
D D 35		9.8	12.1	8.5	9.7
D D 30	*	10.1	9.9	9.0	11.2
1 27		6.7	7.4	7.7	5.4
D D 24		4.5	4.6	4.7	5.2
DD		5.6	4.3	4.7	4.8
D D 18		5.9	5.3	6.4	6.7
D D 0 15		11.0	9.6	8.1	10.3
hanne		15.6	17.7	16.2	15.5
1// 12		14.9	13.6	16.2	15.0
///6		7.3	6.8	8.5	6.9
1///4		3.3	4.0	5.6	6.0
1.1/1		5.3	4.7	4.4	3.3

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# Declining Rate Filtration

Nov.	9-11, 1972	Harrow
July	14, 1972	Sarnia
July	17, 1972	Sarnia
Aug.	2, 1972	Sarnia

Ministry of the Environment

APPENDIX 29

Ontario ,							APPENDIX 29									DIREC	FILTRATIO	IA	
Date	Run #	Temp O _F	F		r Medi Coal		Filtration Rate				idity Eff.	Floce	ulation	Head Ft		Run Length	Total Filtered	Head Lo	
		r	Depth	Eff.	Depth	Eff	IGPM/ft ²	ppm	Poly	Raw FTU	FTU	G -	Time	Final			T	Coal	Sand %
9-11-71	u_7	12	in.	0.45		1.0	2.55 AV	12	0.05	10	0.10	Sec-1	min.	8.0	_	23	3500	93	7
10 <del>-11-</del> 7		42	12	0.4.	10	1.0	2433 AV	12	0.0.	10	0.10	20		0.0	_	23	3300	93	
	H-12	42	12	0.45	18	1.0	2.6	12	0.05	20	0.13	20	8	8.0	-	18	2800	89	11
11-11-7	H-1	42	12	0.45	17	2.0	2.9 AV	12	0.05	18	0.10	20	8	8.0	-	25	4350	_ 29	71
9 <b>-</b> 11-71	i I	42	12	0.45	17	2.0	2.6	12	0.05	18	0.10	20	8	8.0	-	25	3900	67	23
17-7-72	<b>5-</b> 6	52	13	0.4	23	1.0	4.25 AV	8	0	1.5	0.17	20	14.5	7.5	-	31.5	8050	57	43
14-7-72	S-5	55	13	0.4	23	1.0	4.0	8	0	1.7	0.20	20	14.5	8.0	-	33.0	7900	59	41
18-7-72	S-7	52	12	0.4	20	1.5	5 7.4 AV	20	0.2	1.5	0.17	20	14.5	7.0	-	10.5	4650	75	25
2-8-72	S-8	62	12	0:4	20	1.5	5 7.4	7	0.2	1.5	0.13	20	14.5	8.0	-	9.0	4000	75	25
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APPENDIX 29
HEADLOSS DISTRIBUTION RESULTS

Appendix 29
Headloss Distribution Results

1	Í		
	Run #	s-6 s-5	
	Coal Size mm	1.0 1.0	Ц
	Filter Rate	4.25 4.0	Ц
	Filter	H	Ц
	Depth (inches) Headloss		
	- 34	36.7 34.8	
DDD	30	7.2 8.0	
N D D	- 27	5.0 6.4	
DAD	24	3.6 4.2	
DDD	- 21	2.3 3.3	
DDD	- 18	1.8 1.9	
000	- 15	23.3 18.0	
	- 12	15.9 14.9	
1///	- 9	3.0 4.6	
1///	- 6	0.8 1.9	
1///	4	0.4 2.0	
1///			
	0		

1	
Run #	S-7 S-8
Coal Size mm	1.55 1.55
Filter Rate	
Filter	
Depth (inches) Headloss	
32	33.4 15.8
D D 30	22.6 26.4
D 27	10.1 13.8
BP	5.9 12.0
$D$ $\begin{bmatrix} 24\\21 \end{bmatrix}$	2.7 7.1
_	9.3 9.1
D P 18	7.4 6.5
D D 15	7.8 5.2
/// 9	0.8 4.1
, / / 6	0.0 0.0
/// 4	0.0 0.0
' / /.	
0	

APPENDIX 29
HEADLOSS DISTRIBTUION RESULTS

	Run #	H-13	H-12
	Coal Size mm	1.0	1.0
	Filter Rate	2.55 AV	2.6
	Filte	-	
<u> </u>	Depth (inches) Headloss		
	T 30		
A A A A A	. 25	46.8	44.8
	19	37.4	40.6
ADDD	13	8.4	3.2
1///	7	7.4	7.9
1//	2	0.0	2.0
///	0	0.0	1.5
1	U		

#### Run # H-11 2.0 Coal Size mm 2.0 Filter Rate 2.9 AV 2.6 Filter Depth (inches) Headloss 29 26 18.2 23.9 6.5 26.6 20 A 4.3 16.7 14 63.0 21.2 8 8.0 10.3 0.0 0

